JOHN DEERE MODEL "H"

RESTORATION GUIDE

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By: Patrick F. Browning

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Publisher's Statements:

On the front cover: The two smaller pictures are Before and After pictures of H-42820 affectionately dubbed Little Johnny. The featured tractor in the lower picture is of H-23390 owned and restored by Dr. Lon Shell of San Marcos, Texas - finished in 2005.

On the back cover: This is H-47511 restored by Pat Browning, then of New Braunfels, Texas. This is one of 1073 Model HN tractors made - finished in 2004; this picture taken in 2005.

Disclaimer: It is recognized that some words, model names, and designations (as examples) are mentioned herein and are the property of the trademark holder. They are used for identification purposes only. This is not an official Deere and Company publication.

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This Edition will be an excellent tool to anyone restoring, reconditioning and repairing not only JD-H tractors but because of its thoroughness and detail it will be also very helpful to those working on most all two cylinder JD tractors.

Dr. Lon R. Shell,
Contributing Editor

This work is dedicated to my beloved wife of many years
Without whose patience and long suffering this book may
Never have come to pass.

Patrick F. Browning

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Acknowledgements, Co-Editors

Dan Price – Born in 1946 and raised on a diversified farm in scenic northeast Iowa. He has an AAS in Mechanical Technology, and a BS in Mechanical Engineering, both from Iowa State University. Dan was drafted and served in the US Army for two years. As an engineer, Dan has designed specialized overhead traveling bridge cranes, monorails, and other material handling systems for 30 years. He has a particular interest in the evolution of the model "H" tractor. He has one "H" (he says that's all he has time, space, or money for). This tractor was purchased new by the father of a long-time work associate. Eventually, Dan will restore the 1B corn sheller that he cranked by hand for hours as a farm boy. Dan and his wife of 36 years have four children and two grand-children. Their residence is about 15 miles north of Waterloo, Iowa, the home of Two-Cylinder John Deere Tractors.

Gene Johnson -- Raised on the family farm in eastern Nebraska during the period of time when the horse was being replaced by the internal combustion engine, the engine era changing rural and farm life forever! He went on to receive his BS in Mechanical Engineering, and enjoyed a 30+ year career with the Ingersoll Rand Company. Now retired, he is restoring a John Deere Model H tractor, his first (S/N 21141), which belonged to his grandson Ryan's great grandfather. This tractor will be a reminder to Ryan of how those generations before him farmed in the "bread basket of the world" and built a free nation.

Dave Badger -- Born in 1940 and grew up with four younger brothers on a farm in Northeast Ohio. He and Marilyn have been married almost 40 years and have two married daughters. Dave's dad bought a 1949 JD "B" in 1953. He still had horses, so running the tractor fell to Dave, starting him on a path toward John Deere! Dave says, "My Dad always had such a high regard for 'our' John Deere dealer. It was such a treat to visit his store." This fondness started him on a path toward John Deere! In 1958, Dave left the farm for college. During 1962 and 63 he worked the Church of the Brethren mission field in Nigeria, West Africa, then graduated from Ohio State University in June of 1966, and started work at the Columbus Branch of Deere and Company two days later. He traveled as an Area Service Manager for 16 years, then spent another 16 as a Service Training Instructor. Dave retired at the end of 1998, and served two more years! He and Marilyn have moved back to their 40 acre farm where the barn and sheds are full of old tractors and implements -- mostly John Deere including H-9053.

Norb Tennessen -- Born and raised on a small dairy farm in North Central (Phillips) Wisconsin; left the farm after H.S. graduation in 1962 for college (four years at the University of St. Thomas and one year at Michigan State – BS in mathematics) followed by a rewarding 34 year career at IBM. Now retired, he and his wife Kathi of forty years experience the wonders of creation in Woodbury, MN and a return to farming. How wonderful to discover and appreciate that I've been a farmer all along. We still own John Deere H36723 that has been in our family since 1950. Like me, it enjoys a pretty easy life but still runs like it's supposed to most of the time.

Glen Schueler -- Born in 1960 and raised on the family farm in the west Texas panhandle. Grew up riding and watching a John Deere 830 diesel and 70 LP work the family farm, and fell in love with that two-cylinder sound! Later these tractors were traded away in quest of the New Generation John Deere tractors and Glen drove those, 2510, 5010, 4020, 4320, 6030 and 4450 along with using other John Deere equipment. Glen's Dad bought a 1947 John Deere D in 1976 and their journey of restoring the Model Ds began. Having always been fascinated by the magnetos that ran the farm irrigation engines, Glen began working on them for hire in the late 1970s. He is fond of old engines and tractors but most endeared to the John Deere tractors because he grew up with them on the farm. Glen continues the business of overhauling magnetos and carburetors and is still involved with firefighting. His John Deere tractor collection, however, has been whittled down to a 1941 Model H and a 1948 Model D.

Acknowledgements, Contributing Editors

Ben and Jane Wiatrek -- Married over 30 years with three grown sons, both were raised on Texas farms. Ben is a Distribution Line Engineer with the Power Company and Jane a retired public school teacher-turned-administrator. Both are John Deere enthusiasts, Ben whose barn has fifteen JD tractors, is fully addicted to that two-cylinder sound; and both are active members in STOIC (South Texas Old Iron Club), Ben a cofounder and Jane currently Secretary.

Jim Morrison -- Started life in 1929, grew up along with 5 siblings on a small farm in Western Pennsylvania, served in the Korean War, later received BSEE going on to specialize first in FLIR and Stable-Table aero systems (15 years) and then nuclear reactor instrumentation (25 years), retiring in '96. Jim's love for John Deere tractors began in 1941 when the family bought a new Model "H" tractor which served as the only power source for the family for forty years! Jim, now retired, lives with his bride of over 50 years in the wooded mountains of Western PA and they are both active as volunteers in their local church and community. Their current tractor inventory includes a JD Model "H", Ford 8N and a Ford 3500.

Jim Nauert -- Married over 21 years with two grown wonderful youngsters, employed by a small village in New York with a wide range of responsibilities in maintenance; had his interest in John Deere tractors kindled with the purchase of a Model "M" in the early 90's, and has since added to his "bunch". Jim just loves that two-cylinder sound, particularly when under a load, and he always enjoys just being around those Green Machines, whether restored or original.

Joe Howard -- Born in 1939 and raised along with four brothers on a then-medium sized dairy farm in Michigan where he attended a one-room elementary school and later went on to receive his BS degree (Pulp, Paper and Chemistry) from Western Michigan University -- this propelling him to a long career with Scott Paper. Now retired, Joe's new career is building a retirement home on the Styx River in South Alabama. Interest in John Deere tractors dates back to the early 40's and both seeing and hearing the neighbor's 1941 Model B. Joe just loved the sound of that tractor working. He has several tractors, to include a working JD "B" plus two Farmalls, a model "H" and a Cub.

Lon R. Shell -- Retired in 2005 from Texas State University with more than 30 years of service; Professor Emeritus in Agricultural Systems, and have collected and restored farm tractors over much of this time.

Thomas M. Munday -- Born 1935 and raised on a small farm with one brother in Southern Illinois, married with two grown children. He attended the University of Illinois and was awarded a B. S. E.E. in 1957. Following a short stint in the army he moved to Florida to seek warmer weather and employment with Martin Marietta Corp, retiring there-from in 1993 after a long engineering career. Later re-employed as chief engineer for five years at Quantum Technology in Lake Mary Florida. Now fully retired and living in Orlando.

Special Credits, Advisors

Robert Beaver -- Robert's Carburetor Repair <www.robertscarbrepair.com> in Spencer, Iowa is well known throughout the restoring community for being both knowledgeable and helpful when it comes to carburetors and magnetos for the two cylinder John Deere tractors. If you choose to do the work yourself, he has a ready supply of the special tools you will need and high quality replacement parts too. Years ago, Robert helped me to really dig into my old carburetor and bring it back to life. For this I am very grateful. Robert's patience and expertise were very helpful in preparing Chapter 8.

Travis Jorde -- Jorde's Decals <www.jordedecals.com> in Rochester, Minnesota is licensed by John Deere to prepare and sell hundreds of different sets of decals for JD equipment. He will work long and hard to help you buy the right decals for you job. Travis worked many hours with me to prepare the "decal" section of Chapter 2.

Jerry Trcka -- Gauge Restoration is Jerry's main game (715) 635-8629. He spent many days studying to learn the character of gauges installed on tractors as original equipment. He and Jorde have a joint venture going to bring you the very best in restoring your old gauges. Jerry worked tirelessly with me to prepare the "gauges" section of Chapter 2.

Duane Larson -- A lecturer and enthusiast in John Deere tractor ignition systems, Duane was very helpful in selecting the proper language to describe magneto ignition systems related to the John Deere "H" tractors. His countless hours of research served well indeed. Duane's efforts are reflected in Chapters 7 and 8.

Charles Lindstrom -- A long time John Deere Model "H" businessman, Charles provided me encouragement when I was about to toss in the towel on more than one occasion! He has hundreds of hands-on hours having salvaged in the neighborhood of 150 "H" tractors over the years. His expert knowledge of the "H" tractor has been a help to me and to many owners of JD "H" tractors across the nation and many in Canada as well. Charles has always been a loyal friend whenever I needed him.

The Artists and Their Creations

Covers -- Charles B. Schreiber -- Sr. Systems Engineer with Time Warner Cable's Advanced Technology Group. Charles is the head of a new family now including two small children, and is living in Austin, Texas -- not far from the home of his Alma Mater, The University of Texas. His hobbies include photography, UT Football, music, shooting skeet, darts and golf, and family activities.

Diagrams and Sketches – Robert Wu – A freelance artist and illustrator (for some examples see: eportfolio.cfa.arizona.edu/cover.php?portid=950), Rob was born in Buffalo, NY. He never lived on farms, though he has appreciated for many years the fruits of their labors. He now resides with his eminently more accomplished wife Dawn in Tucson, Arizona, where he grows his skills set and cultivates a whimsical sense of humor.

Foreword

This book began with an inspiration to write a story about a very special John Deere tractor. This Model "H" tractor with serial number H-42820 came off the production line at the John Deere Tractor Works in Waterloo, Iowa in 1942. Coming to our family in August 2003, it quickly became affectionately known as "Little Johnny". Prior to joining us, this neglected tractor had spent 12 years in idle seclusion in an old barn in South Texas. After so many years in obscurity, this tractor had lots of needs.

While it was pretty much all there and the engine was not stuck, it had no compression; Little Johnny was a non-runner! The only missing parts of note were the muffler, radiator cap and shutter. The front tires were a total loss. The rear tires were old and weather-cracked but still had some wear left in them and they were holding air! The sheet metal was rough but complete. This tractor was considered a fair candidate for full restoration. The seller and I came to terms on the price and the deal was struck.

Following a year-long program of full restoration, in late 2004 Little Johnny became a "donor" tractor, and was so used to bring to fruition the full restoration of H-47511, an "HN" tractor. You can go to www.jdhpubs.com for the full story on Little Johnny. While there, you may find many other items of interest about your Little Johnny!

What I ask you to do is sit back and read this book cover to cover BEFORE "laying a restoration hand" to your Little Johnny. In so doing, you will gain an appreciation for the comprehensive nature of material contained in this guide. Take in every morsel and learn where the plethora of instructions, hints and tips are to be found. Once you have read this entire " Restoration Guide", draw up the restoration plan, or map for your tractor. Only then will you be ready to lay a restoration hand on your tractor. In short, plan your work and then work your plan! A plan in writing will establish direction and save you money.

Be very sure to observe the importance of the Appendices. There are 18 of them! Some are quite unique. Some are reference such as a torque value chart, and some are detailed, quality-control type Process Plans such as build-up of the engine and of the clutch! The most important thing for the reader is to become familiar with where data items are in this book so that – when needed – they are available! Enjoy! This message is from the **www.jdhpubs.com** website.

Peace on Earth!

Introduction

The primary objective of this guide is to provide an interesting combination of technical information plus tried and proven practical experiences to help the reader "groove in" to the art of restoring an old farm tractor. The information is presented such that you might enjoy the experience without heading to the "poor house". Even though total renewal is the underlying theme of this book, it contains a wide range of practical work-arounds designed to save you money!

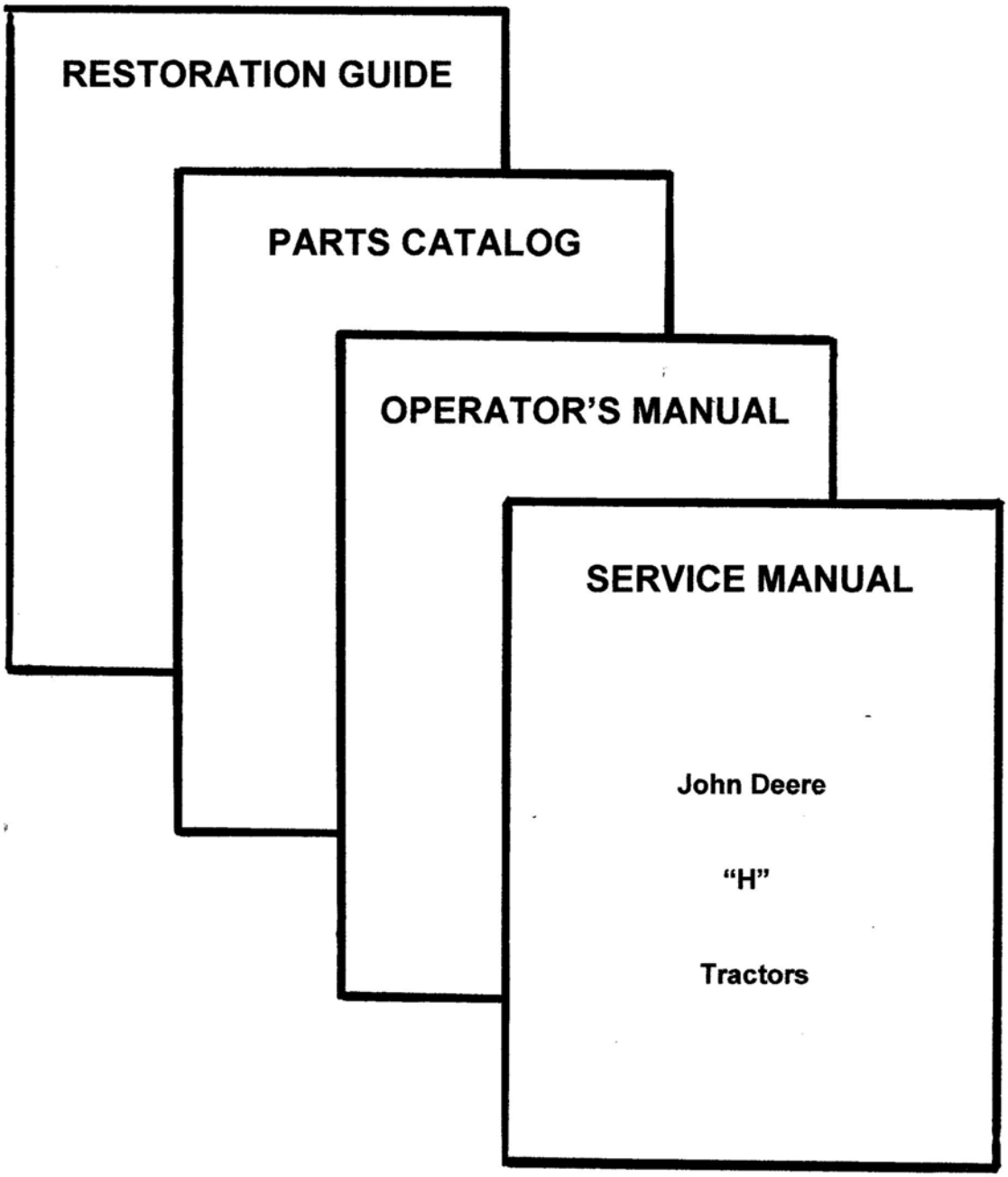
It contains lessons learned, helpful tips, and simple but effective solutions prescribed from the vantage point of a seasoned, disciplined engineer. Each element of disrepair on your tractor is viewed as a problem to be solved. Then scientific methods are used to explore ways toward finding a solution.

While this book will not make you a master mechanic, it will help you ease into mechanics plus provide insight of how the JD "H" works. This text doesn't eliminate the need for a machinist as a partner in your project, but it will definitely help you better communicate with one.

If you are interested in another "How to Restore Classic John Deere Tractors", this title by Tharran E. Gaines is one you will find helpful. The author's approaches to painting a tractor, and his treatise on applying vinyl decals are especially relevant.

Spruce up -- This will be the term used in this book to refer to taking care of all neglected maintenance and repair items that need to be corrected. Replacements for missing parts are acquired and installed, sheet metal defects are repaired, marginal performers like generators and starters are closely evaluated and rebuilt if warranted, and electrical wiring harnesses are fully inspected and repaired so that everything looks and works as designed. Brakes and steering sub-systems are brought back to life, floppiness is removed from all operating controls, and all causes for leakage of oil, fuel and coolant are found and definitively resolved. The tractor is painted, new decals are added and the tires cleaned and coated with black tire paint. A "spruced up" tractor will look great and it will be 'field-ready,' 'field-worthy,' and 'parade ready' when finished. This IS NOT a showroom restoration!

Full Restoration – This term, on the other hand, means your John Deere "H" Tractor will be mechanically "equivalent to new", but will actually look better! Total disassembly is essential. Each part is thoroughly cleaned and closely inspected for serviceability. To be new again, all incidents of wear and tear are to be removed. Every single action listed under "spruce up" will be "enveloped" within a full restoration. However, even more is expected. During build-up, your tractor will pass every acceptance test found in the Service and Operator's Manuals -- so far as is practical. Should a prudent exception arise (e.g. governor-fan shaft backlash), make a decision and document the exception and its rationale in the ship's **Journal**. The goal is to have Little Johnny work, sound, and perhaps even smell like he did new! Indeed, part of the goal will be that the paint detail will look better than the original factory paint job. See "factory painting" in Chapter 9.



Books & Manuals You Need

This is the book set you need to be successful in renewing your Little Johnny for long-lasting service. Remember – while your local John Deere dealership can help by supplying much needed parts, they will be hard-pressed to provide you with Parts research and Service Expertise – thus the need for a Parts Catalog and a Service Manual.

The John Deere "H" – A Historical Perspective

The JD Model H was developed "to meet the demands of small-acreage farmers everywhere for a tractor that will handle all power jobs at rock-bottom cost, and meet the demands of the large-acreage farmers who have always wanted and needed economical auxiliary power to handle lighter farm jobs, John Deere offers the new one-two plow Model H". This statement was quoted from a 1939 sales brochure introducing the new tractor.

Farmers in the 1940's usually rated a tractor's pulling power in terms of how many plow bottoms it would pull. For instance, the early Styled Model A John Deere was rated as a 2-16 tractor, meaning it would generally handle a plow with two 16-inch bottoms. The H was generally rated a 1-16, or a 2-12. In fact, the H is a gutsy little fuel-efficient tractor capable of handling a two-row cultivator depending on soil conditions.

The main goals of the Model H design were to lower the operating costs by using low-cost distillate fuels, lower the purchase price through simplified design, and improve the usability via a 3-speed transmission along with adjustable wheel spacing. The Model H is unique among the General Purpose tractors because drive power was taken off the camshaft instead of the crankshaft, resulting in a 2:1 reduction in speed to the drive train. This eliminated the requirement for bull gears at each axle.

Four Versions -- The Model H tractor came in four configurations: the Model H (a tricycle-style row crop with two front wheels), the Model HN (same as the Model H but with a single front wheel), the Model HNH (same as the Model HN but with 8-38 rear tires), and the Model HWH (same as Model HNH but with an adjustable wide front axle).

The 39-H -- One special breed in the family of H tractors is the 1939 Model, especially in terms of parts peculiarity. The 39 H's could be dubbed the "four-digit" serial numbered tractors (1000-9999). A scan of the Parts Catalog (PC 304) quickly reveals there were a substantial number of changes made beginning with serial number 10,000. Also, the H was the only model variation produced in 1939 (no HN, HNH, or HWH). Changes beginning with 10,000 include the main case, camshaft and associated items on each end, gear shifter parts, PTO parts, and the oil filter to mention a few. So if you own a 1939 H, be especially aware of part number peculiarities below serial number 10,000.

Model HN – This model variation was designed to provide a tractor adapted to the cultivation of vegetables planted with narrow row spacing (28 inches or less). A 1940 tractor built in November 1939 (H11142) is thought to be the first HN. It was an experimental tractor, shipped to the Engineering Department and then to San Francisco. HN tractors were produced to the end. Two of the last five H Series tractors made (61112 and 61113) were HN's. Both shipped to Colorado on February 6, 1947.

Models HNH and HWH – These tractors were developed to meet the demand for higher rear axle clearance and for high clearance adjustable tread front wheels. These are dubbed the "California Tractors" because the need arose in California, and most were shipped there. Of the 37 HNH's made, all but one was shipped to the Golden State, as did all but a dozen of the 126 HWH's. There were also two different front axle housings (narrow and wide, thus offering different tread width ranges) for HWH tractors. All HNH and HWH tractors were produced during a one-year period from February 1941 thru January 1942, spanning production years 1941 and 1942. The "H" tractor plant shut down for tractors and went into war goods production three months later (4-29-1942).

Most Wanted – The John Deere Model H tractor is very collectible. The California tractors, of course, are most collectible because they are scarce! Many of these tractors are still being used on the farm as a backup tractor for everyday chores. Within the huge number of John Deere collectors and enthusiasts, I would venture to say that the Model H tractor is rapidly becoming the "Most Wanted."

Historical Perspective -- Continued:

Depending on your source: (Green Magazine, Two Cylinder Magazine, Yesterday's Tractors Magazine, or The Deere Archives), you will arrive at differing conclusions about the production year for a particular tractor, leading to some discrepancies in the S/N data. Without having traveled to East Moline, Illinois to see for myself, the production data below represents my best effort. When one delves into one of these little gems, the serial number is of much more importance than the year of production, especially when it comes to procurement of replacement parts. And so - - - avoid the argument and go by serial number!

Quantity Manufactured by Model:

H ➔ 57,604
HN ➔ 1073 (Production Log shows a total of 1077)
HNH ➔ 37 [*Two of these are believed to be imposters See note below!*]
HWH ➔ 126

S/N breaks by production year (Two Cylinder Club):

1939 from 1000 - 9999 ** (see notes below)
1940 from 10000 to 20614
1941 from 20615 to 35698
1942 from 35699 to 44753
➔ Wartime break - 4/30/42 thru 4/28/43
1943 from 44754 to 45641
1944 from 45642 to 47795
➔ Wartime break - 10/1/43 thru 10/12/44
1945 from 47796 to 53326
1946 from 53327 to 58613
1947 from 58614 to 61116 (61116 shipped early February 1947)

Note 1. Production for the 1939 JD "H" Tractor began with H-1000. H-1013 was charged to the Service Department and remained in factory inventory until it was outfitted with a wide front and delivered to the Boy Scouts in the Waterloo area on March 1, 1957. H-1013 was used for many years on the Boy Scout grounds and later was replaced with a newer tractor. The front end was changed back to a tricycle front, and the tractor is now displayed at the Pavilion by Deere & Company. One of those involved in the restoration believes it still has the original cast alloy iron crankshaft.

Note 2. There seems to have been a serial number break in the series around H1050, with serial number assignment picking up again with H-1100, which was to have been the first "normal production and delivery" tractor. However, none of the tractors in the ranges 1000 thru 1012 or 1014 thru 1103 are known to have survived. These tractors were either scrapped, salvaged or rebuilt with new steel crankshafts plus other updates as well and given new serial numbers. Some owners will claim to have various serial numbers in the 1014 to 1103 range, but on closer examination it is found that the lower serial number they claim is actually the earlier numbered tractor but it also has been assigned a new, later serial number. As these tractors are found, the production record research indicates the tractor was remanufactured from H-1XXX (spells it out). Additional evidence indicates that serial numbers 9911 through 9999 were never used. The sum of these data would indicate serial numbers 1104 through 9910 constitute the 1939 production of Model "H" tractors, this aside from inference made in the Parts Catalog. These data were sourced, in part, from Two Cylinder (Jul-Aug 89, and Mar-Apr 99), Antique Power (Sep-Oct 92) and Green Magazine (March 04). See also John Deere Model "H" Profile on www.ytmag.com.

Note 3. It has been suggested that two of the 37 HNH tractors were not “factory” HNH tractors. Before completing a purchase for one, contact Two-Cylinder for verification!

TRACTOR SPECIFICATIONS

John Deere series H Tractors, H-1000 and up (all fuel tractors)

CAPACITY -- Handles one 16-inch plow bottom, or a 14-inch bedder (or lister) under normal conditions, and two 12-inch plow bottoms or a two-bottom bedder (or lister) under more favorable conditions.

SPEED -- 1st = 2-1/2 mph, 2nd = 3-1/2 mph, 3rd = 5-1/2 mph, and Reverse = 1-3/4 mph. (Transport speeds up to 7-1/2 MPH at 1800 RPM).

BELT PULLEY -- Diameter = 12-1/4 inches, Face = 4-1/2 inches, RPM = 700 with one roller and one bronze bearing, and belt speed = 2245 feet per minute, (up to 3000 feet per minute with an Over-Pulley) at full engine speed.

ENGINE, TWO CYLINDERS, CAST-IN BLOCK, VALVES IN HEAD --
--Speeds: Slow Idle = 600-650 RPM, Load = 1400 RPM, Fast Idle = 1540 RPM, and Transport = 1800 RPM
--Crankshaft = Special-quality steel, drop-forged, 2-1/16-inch crank pins, Bearings = Two main, Babbitt, centrifugally spun in bearing housing. R.H brg surface is 2 inches long, and L.H. 2-1/4 inches long.
--Connecting Rods = Special-quality steel, drop-forged. Bearings are Babbitt, centrifugally spun in rod. 2-1/16 diameter by 1-17/32 inches long. Bronze bushing for piston pins.
--Governor = John Deere design. Enclosed fly-ball type with 1 thrust and 2 self-adjusting ball bearings.
--Carburetor = Natural-draft type with load and idle adjustment, single barrel.
--Ignition = High-tension magneto with enclosed automatic impulse starter.
--Air Cleaner = Oil-wash type
--Lubrication = Full pressure to main and crank-pin bearings, with oil filter.
--Oil Pressure = between 10 & 15 psi for all speeds, at operating temperature
--Cooling = Thermo-siphon with gear-and shaft-driven fan. (No belts or water pump).

FUEL TANK CAPACITY -- 7-1/2 US Gallons

GASOLINE TANK CAPACITY -- 7/8 US Gallon

CLUTCH -- Two 9-1/4 dry facings attached to a drive disk, locking in and out

TRANSMISSION -- Selective type. Spur gears forged, cut, and heat-treated. Shafts operating on two tapered, two roller, and two bronze bearings.

REAR AXLES -- 2-1/8 inches in diameter. Mounted on four tapered roller bearings, two per side.

REAR WHEEL SIZE -- Beginning in 1939 -- 7-32, 4-ply rubber tires mounted on pressed steel disk wheels. Increased sizes were soon available and made standard equipment: 8-32, 4 ply and 9-32, 4 ply.

FRONT WHEEL SIZE -- 4.00 x 15 inches, 4-ply rubber tires, mounted on 4 tapered roller bearings.

REAR WHEEL TREAD -- 44 inches to 84 inches, **WHEEL BASE --** 76 inches

TURNING RADIUS -- 7 feet, 5 inches

DRAWBAR RANGE -- Vertical Adjustment is from 10 to 15 inches, Horizontal Adjustment is 16-3/4 inches, and Lengthwise Adjustment is 4 inches.

POWER TAKE OFF -- 546 RPM at full engine speed.

DIMENSIONS -- Over-all Width is 79 inches, Over-all Length is 111-1/4 inches, and Height to top of Muffler stack is 73 inches (to Radiator cap is 52 inches).

SHIPPING WEIGHT -- 2054 pounds (1939), 2141 pounds on 9-32 (4-ply) rear tires and 4-15 (4-ply) front tires mounted on cast wheels.

CONDENSED SERVICE DATA

GENERAL

Engine is by John Deere with 2 cylinders, 3-9/16 inch bore with 5-inch stroke. Displacement is 99.68 cubic inches, and displacement ratio is 4.75:1. Compression pressure at cranking speed is 80 PSI. Pistons are removed from the front. Main bearings (there are two) are not adjustable while rod bearings are adjustable for some serial numbers in the series. Engine is not sleeved. Transmission has three forward speeds, and both starter and generator are by Delco-Remy when installed.

TUNE-UP

Valve tappet gap (intake and exhaust) are set at 0.015, valve seat and face angles for intake are 30° and for exhaust 45°. Ignition magneto is WICO type X (was Type C originally), magneto point gap is set at 0.015-inch, magneto impulse trip point is set at TDC, magneto lag angle between 25° and 35°, magneto running timing is set for 30° BTDC. Sparkplug electrode gap is set for 0.030-inch.

Carburetor is Marvel Schebler DLTX-26 (1000-26999) or DLTX-46 (27000 - up), and the float setting is 3/8-inch below casting, or at dead level. Engine rated speed is 1400 RPM, 1540 RPM at high idle, and the PTO speed is 546 RPM at full rated engine speed of 1400 RPM.

NOTE: Carburetor DLTX-107U appeared on the market through Deere as a universal replacement for either DLTX-26, or DLTX-46.

SIZES-CLEARANCES

Crankpin journal diameter and crankpin diameter is 2.0615, piston pin diameter is 1.1045, valve stem diameter is 0.372, main bearings running clearance is from 2 to 4 thousandths, rod bearing clearance is from 1 to 3 thousandths, piston skirt clearance is from 3 to 6 thousandths, and crankshaft end play shall be set to from 5 to 10 thousandths.

CAPACITIES

Cooling system is 5-1/2 gallons, crankcase oil is 4-1/2 quarts (S.A.E. from 10-W to 50 depending on temperature), and for the transmission and differential cavity, capacity is 12 quarts (S.A.E. 140 but use 90 at temperatures below 32°F). See Operator's Manual for further details.

Basics, Tooling and Facility

Chapter 1

Restoration, simply put, is removal of wear and tear, whether due to normal use or combinations of extraordinary use and neglect. Note, the keyword here is removal. Noisy bearings, floppy controls or controls with excessive play, bent things, broken things, and missing things; these are but a few of the most common findings one must deal with in a very permanent way in order to fully restore a tractor. It's also called **Renewal**.

For full restoration, complete, or near complete disassembly is essential. Many call this a "nut and bolt" restoration job. Issues of wear, abuse and/or neglect, if not fully dealt with, will surface sooner or later on in the tractor's new life. The whole idea of RESTORATION is to produce an early model tractor that is, in fact, a new tractor! The tractor should have to pass every test that it had to pass to leave the factory in the first place. Ideally, you would want the result to look, sound, feel, function, and even smell just as it did in the year it first hit the dealer's showroom! But then, we all should know that cannot be. They've taken the lead out of paints! See "Full restoration", page 15.

Terminology

Earlier Restoration -- As one chats with those in the antique tractor community, oft heard will be the term "restored" as if the word had universal meaning. It does not! Another term tossed around a great deal is an "Earlier Restoration" wherein the seller makes a claim, the nature of which he has little idea! So beware if you are planning to buy one! If specific claims are made, ask to see some documentation such as receipts for parts or for machine work done.

Overhaul -- This is another term that seems to have lost its true meaning. This is sad because most people really know deep down, that to "overhaul" is to "reverse the years of wear". No more, no less! In the early years when automobile engines weren't that good, it was common to have one overhauled. The customer expected that overhauled engine to perform like a new one! If done right, they did! When one makes a full restoration on a tractor, he isn't just making the tractor look good; he is making it into what it once was! And "yes", he has every reason to expect it to look good!

Clean up and Paint -- You will come across those who use this term "cleaned up and painted". These words have good meaning to me. And these processes have a real place in the antique tractor world. Many of those claiming to have "cleaned up and painted" a tractor did it with the single objective of making the tractor look good. It was an objective! And that in itself is no small task. See "spruce up", page 15.

Gone Through and Redone -- Many will use nebulous terms like "gone through" or "redone," whatever these mean. What I have come to believe these terms to mean is that they began with the best of intentions, but changed course in the middle of the stream. A full restoration may have been the objective, but when "gray areas" were encountered, they compromised! They changed their objective! When the going got tough, they buckled! Either the added cost was more than they set out to pay, or they ran into something for which they had no solution; figuring to either "live with it", or that it "wouldn't show up"! They resort to using words like these that are really ill-defined, words that can mean different things to different people to disguise what they really did! What a pity! Oh, they were in there alright, but elected to give false blessing and leave it at that.

If you are buying a tractor, be wise. Don't give a full ear to these terms without backup data.

Go Through -- Part of the full restoration process will include some "going through" and some "redoing". I'd use more descriptive phrases to explain. For instance, consider the transmission in a Model "H" John Deere tractor. To "Go Through" the transmission means you have: (1) searched the manuals for specifications that the various sections of the transmission are to meet, (2) made the

observations and/or measurements, and (3) found each observation and/or measurement to meet the written spec's. Item (3) would further imply that if one or more out-of-tolerance conditions were found, they were corrected. And if a condition is found that is not economically feasible to correct, make note of it in your **journal** along with your rationale for your actions. You must spell it out in the Journal. The **Journal** is the written record of the restoration. Remember, the terms "redo" and "redone" are ill-defined so I recommend that you refrain from using them in your journal. See Appendix 9 for a Sample Journal Page.

Work Arounds -- There will obviously be some areas where one cannot take an element back 50 or 60 years to what it once was. A rusted fuel tank is a prime example. Others include repaired castings which aren't available new anymore, the use of fiberglass and BONDO ™ to repair sheet metal parts, and a favorite of mine which is using BONDO ™ or other commercially available fillers to repair voids and deep cracks in a steering wheel. Here, the methods of restoration may in fact be "work-around" procedures using some modern techniques that differ widely from being original. But, if it is a generally accepted work-around, then it is the thing to do. The Journal, however, should indicate that the work-around was used, and describe it or refer to it in sufficient detail so as to be understandable to the reader.

Your Mental Definition

Decide your objective! Write it down, and do not deviate from it along the way without major analysis.

Planning -- We usually start off with a really neat mental picture of what our tractor will look like. But before long you need to prepare a written plan supported by a list of objectives. Make some basic decisions! The key decision in this process is the function you want the end result to perform. If you want a "field-ready" tractor, you concentrate on those attributes that will support its readiness for a season of work. You may not care if the radiator cap is original; or if muffler height is just right, nor that each bolt holding the sheet metal in place is original. If later information indicates that the original plan is not feasible, do the required analysis, establish a new set of objectives, and revise your written plan. The plan directs the work, and performance is measured by meeting the planned objectives. Writing your plan has the effect of making you more willing to follow it!

Spruce up -- You may just want to do a spruce up on your tractor. Surely, there is nothing wrong with this decision.

Full Nut and Bolt Restoration -- If, on the other hand, full restoration is your objective, understand that this course is usually costly. It can put a strain on a limited family budget. It's often said that the most expensive tractor in a man's collection is the one that was very low in cost to acquire.

Replacement parts are often scarce and thus pricey! Discuss the possible cost with others who depend upon your financial well-being. If married, this includes your spouse! Once this decision is made, be determined not to let budget issues cause you to change course along the way. Your time frame may extend, but the standard should not be altered.

Compromises -- Giving in on some sub-objective(s) of your overall restoration plan will stand out like a sore thumb in the final result. You will not get your money's worth because you will end up over-spending in some areas and under-spending where you compromised! The result will be disappointing. You won't even know what to call it, and if you choose to sell it, you will fail to recover your investment! The premise of this book is that one has elected full restoration as the top objective. However, this book fully supports any level of maintenance and restoration on all John Deere Model "H" Series tractors.

On The Other Hand - - -

Read the Tea Leaves -- What if you begin with a "full restoration" objective and then learn that the tractor you started with is in such bad shape that cost of restoration is an unwise decision? This happens! A person is wise to base his decision on the hard facts rather than emotion. With regards to John Deere H-42820, I was led to reevaluate. It was on October 8th, 2003 when I learned the

engine was in dire straits; basically in total need. My first steps were to consult with others 'in the industry' who faced similar circumstances. I had two choices: (1) find another John Deere Model "H" to restore, and use H-42820 for parts, or (2) proceed with H-42820 knowing the cost was going to exceed my original target. At this stage the limited sum of $721 was invested. The number would rise substantially before H-42820 would run again. If one were to break with an earlier decision, this would have been the time to do it!

Gather the Facts, Then Decide -- Typically, the initial investigative and tear-down phases aren't that expensive. If you are diligent and not overcome with emotion, you will be able to recognize major outlays needed as deficiencies are found -- this coming to you before you are committed to the numbers. As a matter of fact, making maximum use of the Virtual Storage Facility concept, I heartily recommend a total tear down and inspection of your tractor before making any major parts-buy decisions. Then have courage, and decide wisely! Also seek counsel from someone you respect as you are deciding. Decide in advance of major outlay. A wise man will consult his spouse as part of the consulting process. In this course of action, there is no loss of honor, no self-delusion!

Be a Great Detective! --- And now the most important mental issue of all is your role as Detective and Investigator! As you make your first real inspection, and later -- as you begin to remove parts from your tractor, continue to list, or **journal** each and every defect you find, large or small. Play the role of Quality Assurance Inspector during disassembly. It is recommended that you choose a three-column format, and record (1) Item number, (2) defect or anomaly, and (3) initial corrective action if known. This will be similar to what is known in aviation as the "781" record for airplanes. A pilot always checks this record for discrepancy write-ups before take off to ensure the plane is safe for flight. This record is your **Journal**, and will become, for you, a "living document". It will change over time, particularly as you learn more about defects you found, and will continue to find. Therefore, leave plenty of "white space" in your initial write-up for the addition of supplemental data. I also recommend maintaining a **Chronicle to the Journal**. This is a document in which to record small, seemingly insignificant events or findings; items that you may or may not want in the final journal. They will include small tests and observations you make along the way, such as how a particular oil or gas line is routed, or dressing of electrical wires or clips. You may elect to prepare a comprehensive summary at a later time. This original discrepancy and corrective action document is raw and unstructured, but also factual in that it states what you saw at the time, and what lead you there!

Be Diligent to the End – You know when the last entry is made in your Journal only when it's over! Recently, only after I received some parts back from sandblasting, did I learn a cast iron water pipe had a six-inch long freeze crack. This was learned only days before it was to be "hung iron"! The detective role starts on Day One, and continues until your tools are finally put away!

Reference Manuals, and Camera --- Acquire the manuals for your tractor. Generally, you will find valuable information in all three of the normal books -- Operator's Manual, Parts Catalog, and a Service Manual. Make reading through these your first act of restoration. Get accustomed to the format, and the wide range of data found; where and in which book it is found. Each is unique.

This is a "Companion Book" -- This book complements the three other books you should have for your tractor. Back in the 1940's, all you needed was an Operator's Manual. The dealer was an owner's bridge to complete service for your John Deere model H tractor. Today, those at the dealership parts and/or service counters weren't even on the planet when these tractors were being sold and serviced by Deere and more often than not haven't a clue how this tractor is put together, nor how it works! Thus -- you now need to have the current parts catalog, a service manual or service guide, and then finally a manual for owners/operators because **you** are now your tractor's Service Manager!

Deere Pubs

Current John Deere publications are the OMR2011 Operators Manual and PC304 Parts Catalog. These can generally be purchased through your local JD-Ag dealer, or from Deere Publications (800) 522-7448. You have a choice of service manuals. One is I&T (JD-4) consolidated shop service manual, and the other is the John Deere Model "H" Service Guide. Earlier versions of operator's manuals, Instructions and Parts List (IPLs) are suitable Operator's Manuals, and perhaps more informative than the current OMR2011 Booklet. The earlier versions come under many names to include DIR218 (1939, H), DIR248 (1940, H and HN) and DIR276 (1943, H, HN, HNH and HWH). So you have many choices and are urged to visit **www.jdhpubs.com** for further guidance as to prices and availability. In summary, you need an Operator's (Owner's) Manual, a Service Manual or Service Guide, and the PC304 Parts Catalog. To forge ahead and open up a tractor without these basic tools is foolish indeed; it's "flying blind".

Study your service manual or service guide. Look especially for CRITERIA information. At some point during the process, you will want to perform all the tests; and if any test fails, make corrections and reapply the criteria. Examples are end-play in various shafts and gear-to-gear backlash. These are must-meet items. Other things to watch for are CAUTION steps such as making sure a part is centered when it is installed.

Don't overlook CRITERA data as found in the operator's manual. A sales feature of the two-cylinder John Deere tractors was the ease and simplicity of performing on-farm maintenance and repairs. Thus, the owner's manual (including the earlier editions) contained virtually all the information needed to maintain optimum performance of the tractor.

The parts catalog will be extremely helpful in illustrating how things go together; a series of "goes-into" charts. If, during disassembly, you become concerned that the manuals may lack sufficient detail to guide build-up, take pictures.

Digital Camera -- A digital camera serves quite well here, and price-wise, a relatively inexpensive means for peace of mind. For instance, I once used a picture that looked into the magneto to illustrate dressing of the leads from points to condenser, and from points to coil. In another case, I took a picture of how the governor went together before disassembly. No great thing here, but I was at peace in the processes, and enjoying the job makes for great sleep!

Another picture that was a big help is the rear tank bracket with its attending ignition wire pipe (spark plug cable conduit - Chapter 2). Were it not for the picture I took I would have had to wait until absolute final assembly to know the relationship between the two, making that task more difficult. Things like this make life lots easier.

I also use the camera whenever I can to take a picture for quality control purposes, such as documenting the connection of an oil line deep inside the belly of the tractor, proving a cotter pin was installed after an adjustment was made, or that needed safety wire was installed.

Publications and Vendor List --- In addition to acquiring the three manuals noted above for your tractor, the prudent man will also take out a one-year subscription to either or both Green Magazine and Two Cylinder Magazine. Each has distinct features you will come to rely on. They are very helpful for sourcing both parts and vendor services, many of which are specialized. For those with Internet access, www.ytmag.com discussion forum can also very helpful. To complement your procurement list and other documents you will generate over the course of the tractor's restoration, you should also develop and maintain a **Vendor List.** The list will include names and the means of contact of various business and non-business associates who are in a position to provide what you need along the way. And you can "grade" each contact for future guidance!

The Setting --- Make available a spacious area for storage of removed parts. See "Virtual Storage Facility" below. An early step in the process, maybe even your second one -- should be a trip to

a local carwash to remove as much unwanted debris as humanly possible. Your first step will be to record (in your Journal) all the signs your tractor has for you. Oil leaks from under and/or from the side of a tractor will tell you loads! Another decision you should make right from the start, is whether or not you plan to have this tractor go through sandblast! If you elect sandblasting (highly NOT recommended), there is a myriad of preparation steps to take in order to control where sand ends up! See separate section on sandblasting. Finally, a primary objective during the process of disassembly will be grease control. Have plenty of paper towels and/or disposable rags handy along with refuse containers into which they go when used up. A parts cleaner proves a lifesaver in controlling proliferation of oil and grease. Keep the floor area dry and clear of obstructions which may result in a fall. Degrease and store parts as you go along.

Planning -- I have always been a stickler for plans and checklists to help me know where I am heading and to measure how far I've gone. Plus there are some things you would like to move along in parallel. There are also some items that have a long process time or series, or a long lead time if being sent to a vendor for repairs. I prepared checklists for degreasing, cleaning and preparation for paint, primer paint, and so on. It is assumed here that the restoration process will take months or even years to complete. Parts scoured up and ready for paint need to have a preservation coat of some sort to prevent oxidation while setting on the shelf!

The Virtual Storage Facility

1. Mini-parts cleaner -- for nuts, bolts, washers and some small parts; it can be as simple as an oil drain pan or a bucket containing mineral spirits.

2. Boxes in bins, or on shelves -- all fairly small:
➔ Breather cover, breather core and felt gaskets
➔ Cam followers and parts
➔ Carburetor
➔ Countershaft and parts
➔ Clutch fork, shaft and parts
➔ Flywheel spacer and parts
➔ Generator w/bracket
➔ Magneto
➔ Oil pump lines
➔ Oil filter body and parts
➔ PTO shifter parts
➔ Pulley brake parts
➔ Reverse shaft and gear
➔ Shifter shaft and shifters
➔ Slider shaft and gears
➔ Springs
➔ Starter w/bracket
➔ Steering parts
➔ Tappets parts and oil line
➔ Wiring harness parts

3. Special Storage
➔ Drawbar (the several parts)
➔ Flywheel
➔ Hood and tanks assembly
➔ Rear wheels
➔ Front pedestal and vertical spindle assembly w/wheels
➔ Rear axle assembly - left, to be broken down
➔ Rear axle assembly - right, to be broken down
** For each axle, use three boxes as follows:
* Axle inner end parts (both sides)
* Axle outer end parts, a box for each side
* Brake parts box
* The two housings remain

4. Stand-up storage
➔ Steering shaft – use steering wheel as a base!
➔ Fan and Fan shaft assembly
➔ (The following five will go to a sort of 'barrel' storage unit):
a. Radiator overflow
b. Ventilator pipe
c. Choke rod
d. Carb-to-governor link
e. Speed control rod

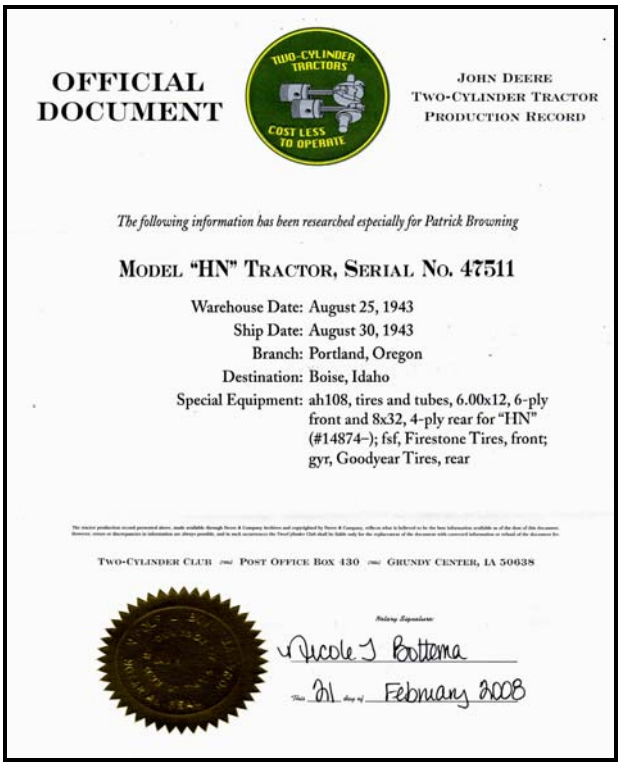
5. Shelf storage
➔ Air Cleaner
➔ Air-in elbow
➔ Belt pulley
➔ Clutch drive disk
➔ Clutch pulley cover
➔ Crankcase cover
➔ Crankshaft

➔ Cylinder block w/rod and piston units
** Block to a shelf
** Rod and piston units each into a box
➔ Cylinder head w/valves
➔ Differential assembly
➔ Exhaust pipe and muffler
➔ Fan shroud
➔ Governor and hydraulic lift unit
➔ Grilles, medallion, center plate
➔ Upper and lower water pipes
➔ Hood support
➔ Main bearing housings
➔ Oil pump
➔ Platform with PTO Shield
➔ Reduction gear cover
➔ Seat
➔ Seat support and casting
➔ Shutter
➔ Tappet cover
➔ Transmission cover (top) with steering support
➔ Transmission cover (rear) with PTO Shaft

6. Wall Hanger Storage
➔ Clutch Drive Disc
➔ Fuel lines
➔ External oil pressure line.
➔ Hydraulic lift hose(s)

Serial Number Plates --- You take pride in your work. If not, you wouldn't be restoring (or sprucing up) an old farm tractor! The tractor's serial plate is especially significant. Many won't even buy a tractor without one! From a JD serial plate we very likely can determine when it went through final Quality Inspection, and also when and where the tractor was shipped.

I once owned a John Deere Model "A" tractor that passed final QA on 29 May 1935 and shipped 31 May 1935. A tractor usually ships the next day after final QA. Why the delay here? Memorial Day fell between final acceptance and shipping! This was before Congress changed Memorial Day to a "floating holiday." 'An interesting note. This kind of information is available from the Two-Cylinder Club for a fee. You receive a **Production Record**. This document may contain codes rather than specific layman's terms to state options originally shipped with the tractor. See "ah 108" in Fig 100.



OFFICIAL DOCUMENT

JOHN DEERE TWO-CYLINDER TRACTOR PRODUCTION RECORD

The following information has been researched especially for Patrick Browning

MODEL "HN" TRACTOR, SERIAL NO. 47511

Warehouse Date: August 25, 1943
Ship Date: August 30, 1943
Branch: Portland, Oregon
Destination: Boise, Idaho
Special Equipment: ah108, tires and tubes, 6.00x12, 6-ply front and 8x32, 4-ply rear for "HN" (#14874–); fsf, Firestone Tires, front; gyr, Goodyear Tires, rear

TWO-CYLINDER CLUB • POST OFFICE BOX 430 • GRUNDY CENTER, IA 50638

Nicole J Bottema
21 day of February 2008

Figure 100. A Typical Production Record

Suffice it to say preservation of the serial plate is a goal to be sought; this even if the tag is in poor condition when you get your hands on the tractor. The numbers for all "H" tractors were stamped on the plate, meaning they are depressed and not raised. Aluminum plates were used until wartime

Figure 101. Aluminum serial plate H-21141 with Paint Drip

demand for aluminum drove Deere to use steel serial plates. Steel plates were on most of the 1942, 1943 and 1944 production tractors. The aluminum plates clean up fairly well with non-abrasive agents. The steel plates, however, will be rusty; but vigorous cleaning is not recommended; surely

no sanding! Pencil erasers, or even a soap eraser is the first step. Perhaps even a gentle wire brush to pull rust from the stamped digits. *NEVER USE SANDPAPER!* Then there are techniques to sort of "raise" the number. Try chalk on the numbers and then wipe it away. Apply white paint, and then remove most of it. Try either method with hope the digits will show through. With good lighting and with a discerning eye, you will read the digits if they are still there. The angle of observation versus the light source makes the difference.

Figure 102. Typical steel serial plate, H-47511

Figure 103. Aluminum serial plate H-21141, inadvertently lightly sanded

Here is a classic case of woe: "Is there any other place with the serial number on this tractor? (**The answer is "NO"!)** I know it is a 1940 "H" and the serial number starts with 179! The tag was readable, but the guy that sandblasted it messed it up. It was covered but the cover blew off and he hit it before he knew it." Hardly a week goes by that I don't read a tale similar to this one. Folks go to great pains to ensure a tractor has its serial tag during the purchase, and then may let their guard down afterward. Read on!

Protect the serial plate during cleaning and painting. Be very careful with scrapers or other sharp objects because they might get behind the plate causing it to warp. Generally, an unfinished area behind the plate will have no effect on the final appearance of your restoration project. Protect your tag with a double layer of duct tape if going into sandblast. You also need to caution your sandblast person not to hit heavily on the serial tag! Then have it covered with blue masking tape during applications of paint coats.
As a matter of general practice, I do not recommend removal of the plate except as part of salvaging a tractor. Transfer or separate sale of the plate is not ethical unless it goes with the very unique group of parts from that tractor that made it unique among others in its model group. The serial plate is held in place with two hardened drive screws (similar to rivets except the shanks have spiral flutes that look like screw threads with a very long pitch) that are driven into holes drilled into the main case. Drive screw P/N is 37H44.

Serial Plate Removal -- *One comment I want to make here is that removing the serial plate and placing it on another tractor is an illegal act in many states. It's been equated to "tampering" with a vehicle identification number.* If one is determined to remove the serial plate, there are only a few ways to do this, and a lower number of them that are successful. One author recommends using a sharp cold chisel "deftly placed" to shear off the drive screw head. He then goes on to say the body of the drive screw is then drilled out of the casting; not an easy task! Drive screws are through-hardened, and are almost impossible to drill into, even with special carbide-tipped drills. I'd leave the drill and its bits in the toolbox for a while. Perhaps something as simple as the sharp point on a draftsman's compass would be handy here -- sort of pick around and see if you can discern movement. Maybe you can put some reverse motion onto the screw with the picking action.

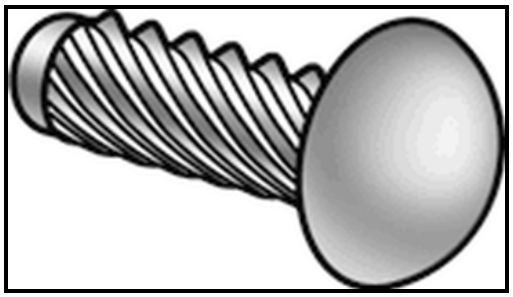
If, in the long run, you end up enlarging the hole, there is always JB Weld to fill the hole and

then redrill it! To abandon the old holes and drill new ones should be a last resort. There are folks who will recognize that in a heartbeat.

Another man planned to use a Dremel tool with a narrow cut wheel to make a screwdriver slot in the rivet heads and then back them out with a screwdriver. This won't work because the flutes have an extremely flat helix angle (approximately one "thread" per inch), and the drive screws simply won't back out by twisting them unless they are simultaneously being pulled out.

Here is a most conservative approach that I have used with 90% success: You will need a rather dull (but evenly so) chisel, a ball peen hammer, and a nice new, sharp vice grip wrench, small to medium size. Place the dull chisel against the drive screw head and give it a gentle rap. Then move to the opposite side of the drive screw head and gently rap it again. Now take the vice grip wrench and nip onto the rivet head and gently back it out. If you hit too hard with the hammer, you are prone to shear the head off. If you don't have discernable movement on the first vice grip attempt, apply the chisel and hammer treatment again, then retry the vice grip wrench.

Any method one chooses demands patience and persistence. For replacement drive screws, visit your John Deere parts supplier, or try a supplier such as McMaster-Carr.



37H44 Drive Screw, Serial Plate

Getting Started --- Now, with that three-column Journal handy, and before you pick up a tool; make a thorough inspection of the tractor. Make note of all missing, broken or damaged, and worn-out parts. You may find something that just isn't right, but its cause is unknown. One example would be a frozen brake pedal. Make it an item, with corrective action yet to be determined. Leave plenty white space in your journal so that during disassembly, you can record additional information as it becomes known.

Initial Tractor Cleaning -- Once you complete your first comprehensive inspection, you have several choices to rid your tractor of years of accumulated leaking lubricants which have attracted countless forms of dust and plant fibers; hardening in the process to have formed an obnoxious coat of sludge. Pressure washing is particularly effective, especially with hot water. You will have to scrape some off. A local carwash may work too, but be sure to clean up afterward. Don't leave a massive "deposit" for others to deal with!

There is no need, during disassembly, to deal with loose dirt and basic oils and greases once these have told you "their story".

Whether or not you use the local car wash step, you can scrape and collect; then dispose. In this operation, you place a large sheet of plastic under the tractor, and proceed to scrape and collect. You can follow up with a wire brush mounted on a side grinder. Finally, in this method, aerosol cans of carburetor cleaner followed up with rags moist with mineral spirits are used to complete the cleaning job. An old paint brush or parts cleaner brush with mineral spirits in an old coffee can also be a big help here. The finale of this method is to wrap up all the droppings in the plastic sheeting and dispose of the wrap in a way consistent with local rules.

If you have plenty of space in which to work, a high-pressure cleaner, usually more powerful than the local car wash nozzles will make short work of any "accumulated" residue that remains. This step, applied between the car wash and the wire-brush step (above), can be very effective, particularly if hot water is used with the pressure washer.

Twisted Wire Brush -- One advantage of the twisted-wire-brush-mounted-on-a-side-grinder operation is to remove rust as well as other

contaminants from the tractor. If you get down to plain rust, mostly removed, but with some rust still embedded, a Rust Converter is a great alternative to sand blasting the entire tractor.

Figure 104. Side-grinder with Twisted Wire Brush -- Safety Glasses are a MUST!

This alternative is most effective on the cast iron regions of the tractor where "contact" wear and tear is not a factor.

Under the heading of "Tractor Cleaning," there are a ton of books out there describing rust removal and paint stripping. Suffice it to say that strippers won't remove rust, and rust converters have no effect on old paint. This writer used stripper in a limited way; a favorite is Aircraft brand aerosol stripper, available at many auto parts and department stores. Small, limited sand blast operations were also employed in hard-to-reach areas and for small assemblies, but off-tractor.

Basic Sandblasting Guidelines

General -- It is assumed that less than 2% of those restoring a JD two-cylinder tractor will have full sand blasting capability. For those who do, see "painting equipment and tools". For those not having such equipment, there are contractors who will sand blast and apply a one or two-part epoxy primer immediately thereafter. When using a contractor, prepare a "picture inventory" as part of a written statement of work (SOW). The SOW promotes understanding by including limits and warnings the contractor must take into account. A picture inventory will establish agreement on the parts going in, and thus ensures you will receive all of your pieces at the end of the job! Anyone who has been to a sand blasting operation will understand how easily small parts are lost!

Choices -- I have often wondered if sandblasting is the cleanup tool for me. Surely, it is the ultimate tool for getting iron squeaky clean. Once I choose sand blasting, should I submit the entire tractor or only parts? It depends on the condition of the tractor. If it's grease-dirty without much rust, I prefer steam cleaning and some "elbow-grease". This allows the existing paint to protect metal until you get around to doing the necessary restoration for the specific sub assembly in question. Perhaps the existing paint can be wire-brushed, sanded down, and used as a base coat. Many "in-between" options present themselves. One such option is to submit an empty main case to an acid bath; gets it squeaky clean, inside and out!

Sandblasting is superior to wire brushing because brushing causes metal to flow over the rough steel surface covering up the small pits (filled with rust). This has the effect of polishing the surface and concealing defects. An acid etch of the surface metal and magnification would be needed to see this, but those tests have been done. Sand blasting provides a cleaner surface because it removes all surface rust and loose metal exposing bare metal but will result in the rougher finish of a raw steel surface. Primer and paint bond better to this rougher clean surface. If the tractor is badly rusted, I suggest sand blasting it. Sand blasting the chassis creates an immediate need to protect the bare metal. A rust converter such as OSPHO comes to mind. Now, a rust preventive such as light oil or WD-40 will work for a while; but will not stop rusting for more than a few days. Various forms of OSPHO™ also work. Whatever the choice, "same-day" protection is needed.

Commitment -- Sand blasting of the entire chassis should be done ONLY if one intends to perform 100% tear down afterward. Blasting without subsequent tear down and clean-up is an invitation to disaster. Despite the most diligent effort to keep sand out, it penetrates!

Sand in Your Ears -- Sending the whole tractor to sandblast is a major decision! Think it through carefully before doing so, taking the following into account: advance disassembly and preparation is required as outlined below.

Caked-on grease makes sandblasting more difficult, a condition that blasters prefer not dealing with. The sand granules tend to "bounce off" unless aimed directly at the grease cake. As mentioned elsewhere, a trip to a self-service carwash, augmented with some scraping will diminish this problem, and may significantly lower the price your sand blast contractor will charge.

Disassembly --- You remove an item to prevent damage to it, and/or to prevent its contamination. Begin with those elements of the tractor that you do not want exposed to sandblast. The list starts with the steering wheel, radiator, gauges, magneto, spark plug wires, carburetor, crankcase ventilating filter, the oil-bath air cleaner, exhaust pipe and muffler, and the entire fuel system. If the tractor has a full electrical system, it all should come off; the battery, generator (or alternator), fan belt, harness and lights. Remove the sheet metal, submitting it to sandblasting separately, apart from the basic tractor. Sheet metal parts should not be subjected to heavy-duty commercial sand blasting. Hoods and grilles call for light-duty sand blasting to avoid overheating and warping.

Plugs, cap-offs and protective covering --- Looking over the listing of removals, it becomes obvious that there now are many places for sand to enter the tractor, and/or damage sensitive parts. These need to be plugged or capped off, one-by-one. I have also used expandable rubber plugs, old spark plugs, jar lids sealed with silicon rubber, bolts and flat washers, pieces of plywood cut to fit, bolted them in place and sealed with silicon rubber. Rags stuffed into small cavities, such as into the gear shift to protect the gear shifter boot also work very effectively. Finally, there is duct tape. Apply several layers to rear wheel axles, and splined areas of the crank and power shaft. The rule of thumb -- if you aren't going to paint a surface, don't allow sand to blast it. Remember to apply DOUBLE or even TRIPLE layers of duct tape over the serial plate to prevent irreversible damage to that precious object!

Wheels --- Circumstances will drive you on these (no pun intended). You will need to have the wheels (with tires) installed to get the tractor from one place to another (as in from your shop to the sand blasting pit, and back). Whether or not you have them on at the point of sandblast is largely a function of where they are dealt with in your overall plan. If they are to be processed later, and do not interfere with the sand blast effort on the basic tractor, I say leave them on. You can then bring them to sand blast separately, as with the sheet metal. Somewhere along the line the tires will be dismounted to allow sand blast and prime paint of the rims, inside and out. On the other hand, if you do not plan to sand blast the wheels, it may be a wise choice to remove them once the tractor is in place at the sand blast pit. Both wheels and tires are dealt with in depth, in Chapter 6.

Tires --- New tires are a major cost item. If the tires now on the tractor remain serviceable, submitting them to sand blasting is an effective method of basic cleaning. A word of caution here on the tire sand blasting operation; the sand blast man needs to be really gentle when shooting near the tire bead; on which little, if any, sanding action is required, and to which major damage can be done. Two layers of duct tape should be applied to the bead to block a hit with sand blast. Once cleaned this way, a couple coats of a quality black tire paint does wonders. Tire paint will not close weather cracks, but will deemphasize the unsightly impression they give. Beyond the cracks, they clean up like new!

A Personal Opinion -- Sandblasting the entire tractor sounds like a good decision when you have layers of rust commingled with layers of old paint, all complicated by a mix of stubborn oils, greases and agricultural residue! I recommend sand blast is such a case. However, many H tractors will clean up quite easily. And for those, I lean toward the notion of sand blasting for only sheet metal (be careful here) and some other select items such as radiator tanks, wheels, parts of the seat

subassemblies, and perhaps the clutch pulley cover. Use alternate means of cleaning elsewhere. I also acknowledge alternate methods of cleaning to include variations of "lye gravy" and electrolysis. You may choose to experiment with these and form your own opinion. Bottom line, there is no "magic wand" to wave over an old tractor and have it become all new again. Cleaning a tractor is work!

Fasteners -- Called Nuts and Bolts! --- All of the nuts and bolts used in the original production of your tractor were the very best that money could

Figure 105. Fasteners, cleaned & sorted -- Ready for Paint

buy! Be advised that mechanical engineers decided on their use. The engineering is done. Rely on it and plan to reuse the original fasteners as long as they are serviceable! I recommend use of a bucket or an oil drain pan to accumulate nuts, bolts, washers, and other really small parts as you proceed in the disassembly process. Place solvent such as mineral spirits into the pan. The pan with solvent becomes a miniature parts cleaner in itself. Eventually, every nut, bolt and washer will be wire-brushed, inspected, filed or ground to remove burrs, and receive paint prior to reuse.

Chasing Threads -- Every nut should be chased as well as bolts with burred threads. When painting, bore holes in a cardboard box, insert bolts, then spray. This will protect against getting paint on the threads. To paint nuts and washers lay them on top of a box. When this hardware comes out of painting, sort by size (bolt diameter) into smaller boxes. This step makes finding needed bolts, nuts, washers, etc. easier during build up.

Figure 106. Fasteners set into holes, or on top of cardboard boxes for painting prior to reuse.

As you visualize this, you may have some trepidation about where all the nuts and bolts go during build up. That's where your parts catalog comes in. Each nut, washer and bolt generally is listed by size and/or description, with illustration of where it goes. For example, let's say you are mounting the carburetor onto the tractor. Find the page in the Parts Catalog that contains the carburetor and within the illustration will be the bolts by key number (or item number). Then read the description of the key number that goes with the bolt and you should have the size of the bolt by diameter and length, and how many are used. Refer also to this Parts Catalog page for washers to be used, or for a safety wire call-out.

To recap the process -- (1) fasteners go into a mini parts cleaners as they are removed, (2) when disassembly is done, finish the initial clean and dry operation, (3) with the bench grinder and wire-brush, clean each piece so it is totally free of rust and contaminants, and looking like new; this step also includes a close inspection of each part for burrs and bad threads, (4) use files or a grinder as appropriate to remove burrs on bolt heads and/or nuts, (5) use dies and/or taps to chase jimmied-up threads, (6) apply paint to bolt heads, nuts and washers using the "box" method above, and (7)

sort all pieces by diameter into smaller boxes so labeled. These seven steps will provide a near perfect set of fasteners for assembly operations as long as you have (a) replaced each defective fastener as it was discovered, and (b) you continued to be a super, discerning detective during the cleaning and inspection process.

Working Clean -- Whether or not your work plan includes eventual painting of the tractor, decide to work clean. Working clean is working safe and wise. Preparing to put your tractor back together must include parts and fasteners 100% free of any old grease or dirt. Fasteners must be in like-new condition in accord with their own seven-step process for renewal. And how can close inspection of your tractor's parts be accomplished without first being cleaned? Just imagine installing ringed pistons and hooking up the connection rods with the parts still covered with old engine lube, age-old oil sludge in the crankcase, and the nuts coming out of a bucket filled with the tractor's un-cleaned fasteners loaded with grease and dirt! It is extremely difficult to remain mindful of the important details at hand while at the same time constantly cleaning your tools and hands of grease, oil, and field grime. The distraction of searching through those dirt-laden nuts and bolts for the right ones is enough to cause mistakes!

Errors that Cost Money-- Most errors in a restoration that cost you money are made during initial disassembly or teardown. Castings are broken, far too many bolts are twisted off, non-standard parts get tossed into an old bucket along with nuts and bolts, no-longer-available retainers are bent up and thrown away, precious shims are wrinkled up or destroyed, and valuable data is lost when old worn-out bearings and seals are trashed.

Almost any brand and model tractor will have some interfaces where pilot or guide pins are used to precisely position one casting to another. The JD "H" governor is one example. This type of interface must be separated squarely. You pry only one side up and one of the two castings will be cracked where the second pilot pin is located. Cap screws that have not been moved for a half-century must be nurtured. Applying brute torque force to remove them without pretreatment or other "smart techniques" will bring you a lion's share of machine work to restore threaded or tapped holes.

Bag and Tag -- Every tractor has a collection of special brass or copper washers that serve as seals in some way, springs that do special things, shims of differing sizes and unusual nuts and bolts here and there. Make a note of these and of their uses in your **Journal** so that they will end up in the same role in your new tractor. I recommend you take time to bag and tag these special pieces. Why? The Parts Catalog usually doesn't contain enough data for you to recognize these parts. They carry a part number assigned by Deere (See end of Ch 6 and App 16), and without benefit of the Deere drawings during buildup, knowing only the part number can fails you. You can't link the item using the Parts Catalog! So, take the time to bag and tag such items, and store them so that retrieval isn't another mystery to be solved. A Zip-Lock plastic bag marked with an indelible marking pen works great for this purpose.

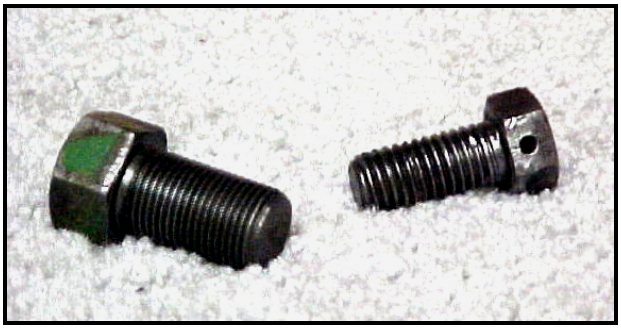


Figure 107. Examples of special, non-ordinary fasteners to be journaled, or bagged & tagged

Welch Plugs -- While not fasteners, they are quite basic to machining of castings and may bring you cause for concern. These are those small, pressed-steel type plugs we quite often call "freeze plugs". If you were to look behind the plug you would probably see a machining for a shaft such as the countershaft in a transmission. So, in effect, these are drill plugs. When the drilling or machining process was completed, a simple, low-cost plug was inserted. Replacements are widely available both from John Deere and local auto supply stores. Measure the hole in 32nds or 64ths of inches to

determine the right size. Apply a soft gasket sealer around the plug edge before you punch the center to expand it when installing a new one. See history of the Welch Plug at end of chapter.

Journal Part Number Data -- Generally speaking, replacements for bearing and seal retainers in tractors several decades old are no longer available through dealerships. Unless they are destroyed during teardown, a little tender loving care will make them fully reusable. Replacements are often available for shims, but more often than not they are of paper rather than the steel originally used. Avoid damaging them during teardown. Study your parts catalog before taking pieces apart, and thus be informed that the interface area contains shims or spacers, and then work accordingly. One final area is old bearings and seals that you plan to renew. Making a record of manufacturer and manufacturer's part number from each worn-out bearing and/or seal you remove broadens your ability to search for a replacement. You aren't totally dependent on your John Deere dealership! As you reflect upon this paragraph, tearing into a tractor without having at least the Parts Catalog and a service manual is a foolish thing to do. Many tales of woe are to be heard from those who did!

Your Procurement Log, A transitory document

Another "living" document that has served me well is a procurement log. It is transitory in that items entered therein are deleted as the requirement for each is satisfied. As one proceeds in the disassembly process, he will come across an item that is no longer serviceable. Decide on the spot to replace it! Accordingly, enter this part in your "procurement log". This log can also serve as guide to procurement of services one would receive from a machine shop. This will be a working document, changing as each item is satisfied. This log also serves as a weekly shopping list, having made note of the store (or vendor) from which you expect to shop. As you make your weekly shopping runs, touch base at the appropriate store and satisfy the requirement(s). If it is a replacement bolt, fetch it and drop it in with serviceable ones taken from the tractor. They will all "come out in the wash" as they say! No surprises and no shortages! Strive to purchase the very same size bolt you are replacing. John Deere tractors have lots of "1/4-inch" lengths (Example: 5/16 x 1-1/4 inch machine bolt). Most fastener outlet stores carry inventory of 5/16 x 1, and the next size is 5/16 x 1-1/2, skipping over the bolt that is 1-1/4 inches long. Such bolts usually are special order items but ARE available in hardness grade 5. The added effort will pay off during final assembly. You have maintained originality and will use the bolts called for in the Parts Catalog.

A Note of Caution -- When buying replacement bolts, be certain you purchase bolts with hardness of grade 5 unless otherwise specified. You will usually find these in a store like Fastenal, Inc. or any other establishment with "fasteners" in its business name or logo. You can tell the grade of a bolt by observing the markings on its head. See appendix 2. For grade 5, see three marks toward the center of the head. The zinc-coated utility type bolts carried by places like home improvement stores will generally be grade 2 (no marks at all) or grade 3 (two marks), and are generally not suitable for use as fasteners in farm machinery.

Part Number Make-up -- For the "H" Tractor, the traditional Deere numbering scheme is one or two letters, then a number followed by the letter "R". Most all bit and piece parts will have the single letter up front. Use of two letters, particularly when the first of the two is "A" as in AH or AR, indicates two or more pieces have now become one in this part. Subassemblies usually carry the two-letter designation scheme. Becoming this familiar with your parts catalog is a must. Given a part number, you can quickly find where it goes by looking it up at the back section of the parts catalog where you will find the page it is on and its key number as well.

Part Change Without Part Number Change -- Most manufacturers of a complex product like a tractor, automobile, or even an airplane will constantly be making changes to parts during the period of manufacture. As problems develop either in the field or in the factory, liaison calls are generated and sent to the engineering department

involved. If warranted, an Engineering Notice of Revision (NOR or ENOR) will be issued to make the change, and the change is usually implemented immediately where the affected part is changed. But if the revised part will function fully on earlier versions of the end product, the basic drawing number (and part number) IS NOT CHANGED. This is particularly troublesome for one attempting an authentic restoration of the early tractors and demands research and discernment. Examples for the JD "H" tractor are the H435R Brake Latch, the H396R L.H. Governor Bearing Housing, and the AH608R platform. The latest version will fit earlier tractors, but the earlier version may not work on the later tractors! The AD1606R seat changed at least three times during JD-H production, but all seats are directly interchangeable both ways. Today, the AD1606R is square and without holes!

JD Parts Homepage -- This is a ready tool for those having Internet access. The simplest way to establish initial contact is to go to Google, and enter "jdparts". Finding your part here also gives pricing and availability data. One of the entries when you set up initially is your local dealer. This site gives you the power to actually look on that dealer's shelves to see if he has what you are looking for, and how much it will cost you! As indicated above, nearly every part in the "H" tractor has the letter "R" as its last character in PC304. It IS a part of the part number, but it isn't always the best way to research your part on the JD Homepage. Always begin with the full part number including the "R" at the end. If this fails, try the part number without the "R" suffix. Bearing part numbers are a classic example here. The "R" has very little if any meaning with bearings. Be aware that a couple bearings have a suffix other than "R" which may indeed change the meaning of the part number, so again - try it both ways. Fasteners are an interesting feature. If yours is found, you will see a basic engineering description -- such as a machine screw, where you receive diameter and length data plus how far down the bolt the threads go! Bear in mind, however, that data here is "replacement data" which means the JD Parts Homepage WILL NOT tell you that hex head clutch drive machine screws are used on a Model "A" tractor built in 1951 (which is true). You would only find the hex head data and not the drive data -- which is indeed a bona fide replacement, just not original. You might discover that the JD Parts Homepage is a living extension of your parts catalog, and by "living", I also mean changing.

Abbreviations -- Throughout the remainder of the book, shortened terms will be used here and there in order to better focus on important issues.

S/A ➔ subassembly, S/M ➔ sheet metal, SM ➔ Service Manual, Svc Gde ➔ Service Guide, P/N ➔ part number, I&T ➔ Implement and Tractor, SOW ➔ Statement of Work, FSB ➔ Field Service Bulletin, IPL ➔ Instructions and Parts List, and NOS ➔ New Old Stock. One other shorthand notation used is in relation to the Parts Catalog such as (21-6), making reference to page 21, key 6.

Tooling and Supplies

Just being one of the "smarter bears"

The Prudent Man -- During disassembly, many fear the unknown. A major unknown and unwanted event is twisting a bolt or stud off in a casting. Another is a screw head so dinged up that normal tooling will not fit to get the job done. The prudent man will minimize these fears by selecting the right tool for the task at hand. Also, penetrating compounds (used ahead of time) and the application of heat can be helpful allies.

Consider the hammer as a "last resort". Remember that, old castings are ordinary gray iron, and that usually means BRITTLE! They will break. Indispensable tools in your arrangement will include shop air and an air impact wrench with 1/2 inch drive. Oftentimes, a stubborn stud is eventually backed out of a casting using an air impact driver. Remember, some of these bolts have found their home inside that hole for sixty or more years. Patience, persistence, and wisdom serve one well here.

Hand Tools -- Quality hand tools and shop tooling are essential to adequately restore a John Deere Model "H" tractor.

@ Flat blade screwdrivers (1/8 - 1/2 inch)
@ Phillips head screwdrivers (#2 and #3)
@ 3/8 inch drive sockets up to 3/4 inch
@ 1/2 inch drive sockets up to 1-1/4 inch
@ Added sockets of 1-5/16 and 1-9/16 inch
@ Combination wrenches, 3/8 to 1-1/4 inch
@ Obstruction wrench, with 9/16 at one end
@ 3/8 drive crowfoot wrenches, 3/8 to 1 inch
@ Adjustable wrenches, 6, 8, and 10 inch
@ Vice grip wrenches, 6 and 8 inch
@ Strap wrench suitable for 2-1/8 inch shafts
@ Chisel and punch set
@ Tap and die set, 1/4-20 to 5/8-11 UNC
@ Tap and die set, 1/4-28 to 9/16-18 UNF
@ High performance drill bit up to 1/2 inch
@ Standard (square shank) easy-out set
@ Hole punch set up to 1/2 inch
@ Micrometer good up 2.25 inches

The tap and die sets are needed to salvage nuts and bolts that have been marred over the years. Also, every tapped hole on the tractor needs to be "chased". There are three kinds of taps: starting, intermediate, and bottom taps. The bottom taps are best-suited for chasing threaded holes in tractor castings, especially “blind” holes.

Final assembly of your new tractor will require tightening bolts to a specified torque value. Charted torque values apply to clean smooth lubricated threads on NEW fasteners -- this is straight from any book on standard torque values. Hopefully, you won't need your easy-out tools -- but that one time is enough. The hole punches are for making gaskets (the bolt holes).

The list of hand tools continues:

@ Pliers, regular, diagonal and long nosed
@ Awl
@ Magnetic pick up (fetch) tool
@ Hammers, a variety (a lead mall is helpful)
@ Shears and draw knives
@ A pair of bolt hole alignment tools
@ Files, assortment of round, flat and triangle
@ Small (6 inch) steel rule
@ General caliper
@ Snap ring removers, an assortment
@ Snap ring installers, an assortment
@ Gear pullers, small and medium
@ Steering wheel puller
@ Heat source (ex: small propane torch)
@ Pry bars
@ 3/8 inch portable drill
@ Wire brushes to use with the drill
@ 6 to 9 inch side grinder
@ Twisted wires brushes for side grinder
@ Hand-held wire brushes, assorted size
@ Cylindrical hones, 3/4 to 4 inches
@ Torque wrench good to **180 ft-lbs**
@ Standard thickness gauge
@ Scrapers, an assortment of widths
@ Hacksaw
@ Toothbrushes and popsicle sticks
@ Automotive type spray gun

Wire Brushing Operations -- Wire brushing plays a significant role in preparing surfaces for paint and for cleaning nuts and bolts. Wire brushing can be done a number of ways: by hand while a part is held in the vise, by hand-holding the part with a vice grip to a wheel brush on a bench grinder or to a wire brush wheel mounted into your 3/8 inch portable drill (with the drill in the vise), or by grunting it out with your 5/8” drive side-grinder equipped with a tough, twisted wire brush for the real hard stuff -- like the tractor's belly. Eye and hand protection is mandatory!!

Figure 108. 9/16 x 5/8-inch Obstruction Wrench and 3/8, 5/8 & 1-inch Crowfoot Wrenches (3/8" Dr)

Shop Tools --- "Must-have" shop tools include a parts cleaner, bench grinder with a wire brush, bench vise and an air compressor. A pair of sawhorses and a drill press will also be handy. You will also make tools. Sawhorses modified to act as "ponies", or mock-ups for sheet metal parts will be a big help, especially for reworking and painting the hood. A wire "clothesline" consisting of 9-gauge wire stretched between two poles works well when painting piece parts and small subassemblies for later installation. A ceiling hoist or engine hoist will be very helpful as well. For springs that do their work by stretching, one may make a small frame to stretch springs out to make cleaning more efficient, and so they can be painted inside and out. Lifting, blocking, and chocking operations call for a hydraulic jack or two, wheel chocks, perhaps a hoist, and either 2x4 or 4x4 wood pieces some 18 to 24 inches long to serve as blocking to hold the tractor up.

Well-maintained Tools -- What is the condition of your tools? Worn-out screwdrivers account for nearly 100% of all screws with stripped-out heads! Discard them! Keep your tooling clean and well-maintained. Replace the worn out ones. Resolve always, to take the time required to fetch the right tool for the job at hand. If you don't, you will wish you had after it's too late!

Glass Bead Cabinet -- A small sandblasting cabinet such as used by auto machinists is extremely useful, but not essential. Many of the parts needing sandblast are fairly small, and this little guy makes short work of these tasks. Carburetors should not be sandblasted! The reason is metal loss. These old carburetors have already yielded plenty of base material due to 6 decades of rust. Glass beads bounce away from the base casting, bringing caked-on rust and corrosion with them. Sand granules, on the other hand, cut into the metal. Cutting is not needed and is to be avoided.

Body Work Tools -- There are several sets of various tooling you will need for "body work" on the tractor's sheet metal parts. A standard hammer and dolly set consisting of a couple of different hammers and several dollies. Dollies are small anvils applied on one side of a dented piece against which one uses a body hammer to bring sheet metal into alignment. Finally, a couple types of sanders come in handy; a dual-action (orbital and straight), plus a pneumatic rotary sander as used in automotive repairs.

Figure 109. A set of body hammers and dollies for sheet metal repair work

Figure 110. Safety Gear

Safety gear -- Plan to use rubber gloves when handling harsh solvents. Canvas gloves come in handy during painting, and also during wire brush operations along with eye protection. An ABC fire extinguisher is basic shop equipment to have on hand.

Safety -- For eye safety, have multiple pairs of safety glasses handy and use them. Wear them for all activity involving abrasive operations, and in any instance where something may become airborne! Jersey or canvas utility gloves come in

handy when using the bench-mounted wire brush. Rubber gloves should always be worn when handling solvents or paint additives such as hardeners. A fire extinguisher is a must. It needs to be one suitable for petroleum-based fires. For spray painting operations, you need a respirator and a very special collection of protective items; See "painting equipment and tools", Chapter 9.

General Shop Supplies Used

+ Aircraft brand paint remover (aerosol)
+ Anti-seize thread lube (tube)
+ Blue masking tape, 1" & 2" (rolls)
+ BONDO™ mix (kit)
+ Carburetor cleaner (aerosol)
+ Cotter pin assortment
+ Duct Tape, 2-inch
+ Filler primer (aerosol)
+ General purpose lube (Ex. STP AP-45)
+ Graphite packing -- (3/16 inch diameter)
+ Hi-temperature bearing grease (can)
+ Indian Head Shellac (by Permatex)
+ JB Weld (tubes)
+ JD Classic Green paint (aerosol)
+ JD Primer paint (aerosol)
+ JD Graphite Lubricant (aerosol)
+ JD Muffler Black Paint (aerosol)
+ JD Blitz Black Paint (aerosol)
+ Mineral spirits (gallons)
+ Oil dry compound (bag)
+ Paper towels (roll)
+ PB Blaster (aerosol), or Kroil (Kanolabs.com)
+ Permatex 2B (gasket sealer in tube)
+ Permatex # 3 (gasket sealer in can w/brush)
+ Pipe dope (in can w/brush)
+ Plastic sheeting
+ Propane torch fuel
+ Rust Converter/OSPHO (aerosol cans)
+ Rustoleum Hi-gloss paint (aerosol can)
+ Safety wire, 18 ga.
+ Sandpaper -- wet-n-dry
+ Silicon adhesive sealant (tube)
+ Steel wool
+ Teflon tape (roll)
+ WD-40 (aerosol)
+ Wire brush wheels (for drill in vise)
+ 6 inch Wire brush for bench grinder/mandrill
+ Wire brushes for side grinder

Flywheel Wrenches -- Figure 111 is an illustration of a simple but effective homemade flywheel wrench that has worked very well for me on hand start JD Tractors model "A" and "H". I am sure this tool will do equally well on many others because you can simply install the socket to fit the fastener at hand.

Figure 111. Locally made Flywheel Wrench. This wrench is made from a 19-inch long piece of 3/4 inch round bar stock and a 7-inch section of a 1/2 inch drive handle. The angle between the welded pieces is roughly 130 degrees.

Figure 112. H512R Wrench. This photo shows the regular or standard Flywheel wrench for the John Deere Model "B" and "H" Tractors.

JD "H" Parts, the Precious ones -- Many parts on your "H" tractor are becoming "high-value" pieces at a rapid pace! During the restoration process, and particularly during teardown, treat all parts with diligence and care. Ideally, you should remove and treat each part as if it is the last one in existence, and that you will have to reuse it! As

you proceed along your restoration journey, consider the multiple ways to "bring these items back" to a life of service short of outright replacement. Replacements are getting harder to find, and when they are found, the asking price strikes one sober!

The hood once topped the list. At this writing, there is a new after-market source – Detwiler Tractor Parts. Of all the John Deere farm tractors of the JD "H" era, it is safe to say the JD "H" hood is the most complex one of the bunch, and the most pricey. Other expensive parts include the brake latches (H435R), any governor parts including replacement bearings, carburetors and magnetos.

Missing parts are a constant challenge that one faces in restoring any tractor now some 60 years old. The "H" is no exception. Shields, shutters and spark plug covers top this list along with radiator caps. All in this group are available for a handy price! Fenders also come to mind here -- The "H" tractor looks so very good with fenders!

Rounding out the list at this writing are the AA499R fuel filters, fuel tank assemblies, throttle levers, governor and fan shaft parts, brake parts, starters and generators, plus wheels and tires! Any list of scarce JD "H" parts absolutely must include over pulleys (item # 72 on pages 10 & 11 of PC304), and the "can" type PTO cover (item # 59 on pages 28 & 29 of PX 304). If you do find them, you most likely will NOT find them for sale!

Fenders

Fenders were probably less prevalent for the "H" Series tractors than for A's, B's and G's. And of all tractors shipped, those without fenders far outnumbered those that had them.

For the Model "H" tractor, fenders did not even make it into the PC304 Parts Catalog. They did appear, however, in Repair Catalog No. 59-R, October 1944; AH758R for the right hand fender, and AH759R for the left hand fender.

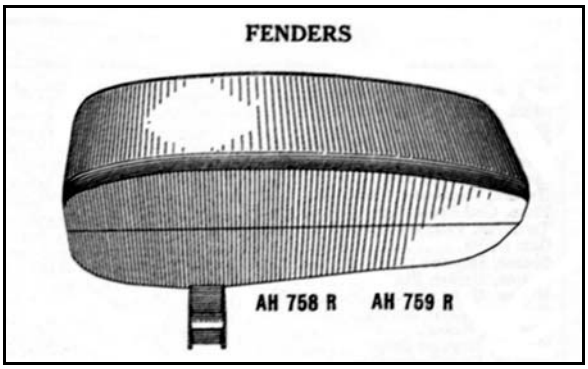


Figure 113. JD "H" Fenders

Other factors come into play. For instance, the State of Michigan is said to have enacted a law requiring fenders to be installed. It comes as no surprise that more fenders are for sale in Michigan than in any other state. Both original and after-market fenders are generally available.

Field Service Bulletins -- A vital part of the John Deere Product Support Mission was a series of Field Service Bulletins (FSBs). An engineering arm of the tractor company staff prepared brief notices containing new methods or correcting existing ones, announcing new parts or combinations of parts, or to amplify on technical information already published. The main purpose of the FSB series was to support branch houses and dealerships; and in particular, the JD technicians! Today, they are useful for historical data as well as their technical content. Go to **www.jdhpubs.com** to acquire FSBs on CD applicable to the JD "H".

John Deere Series "H" Oiling (DIR276)

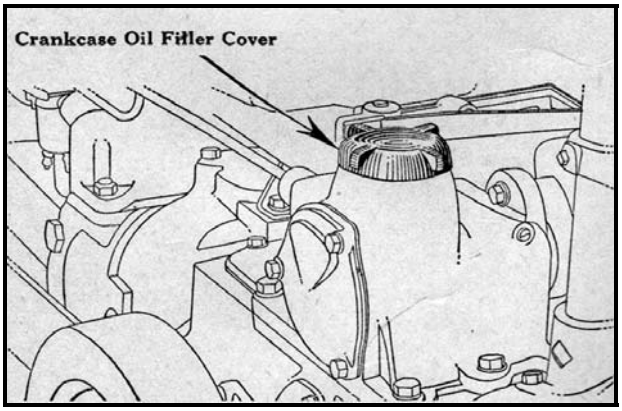


Figure 114. Crankcase Oil Filler Cap

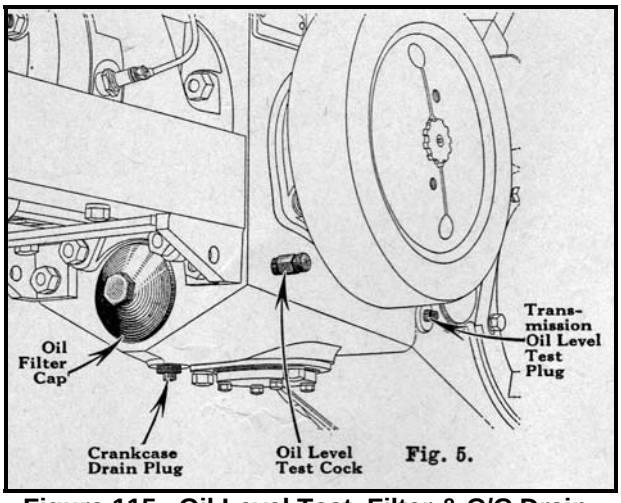


Figure 115. Oil Level Test, Filter & C/C Drain

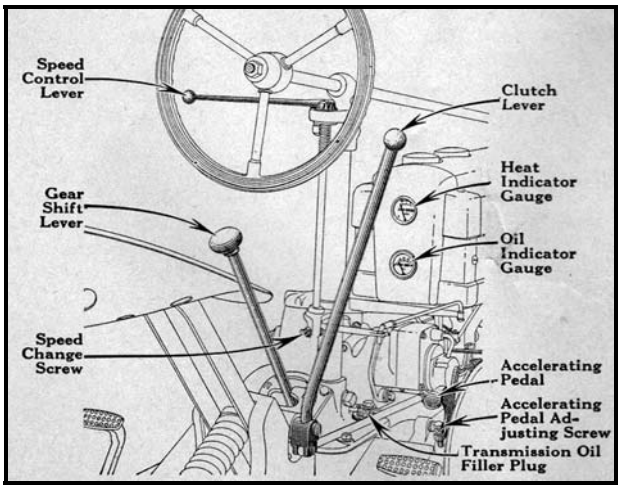


Figure 116. Transmission Oil Filler Plug

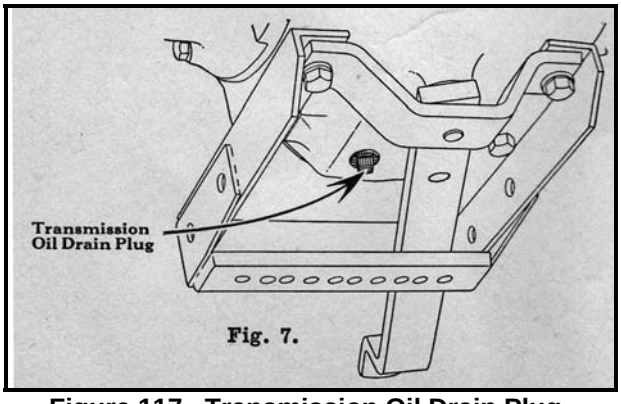


Figure 117. Transmission Oil Drain Plug

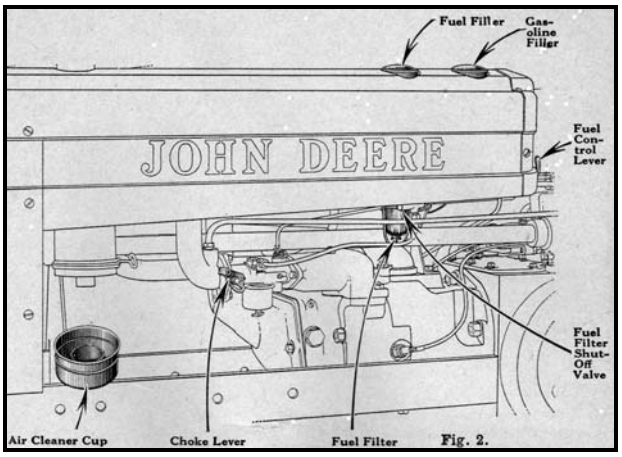


Figure 118. Engine Fuel & Air

Brief History of the Welch Plug

A brief bit of totally obscure history that I am one of the few living persons who knows.

My family business, established in Pontiac, Michigan in 1905, is the original manufacturer of the "Welch" plug. The Welch brothers had a motor car company at the turn of the century that was later bought by General Motors - the Welch Motor Car company. They would run the cars around Pontiac to "break them in."

At that time core holes in the engine blocks were fitted with pipe plugs. During one of these run-ins a pipe plug backed out. In order to get back on the road one of the brothers drove a quarter or half dollar into the hole. From this they developed the Welch plug, some with the help of my Great Grandfather Martin Hubbard. They then patented the plug and the M.D. Hubbard Spring Company became the sole manufacturer of the Welch plug for the life of the patent. To this day we have the largest range of sizes available anywhere.

So the Welch plug in origin is an American innovation and name.
Best Regards,

Nevin Hubbard
M.D. Hubbard Spring Company
www.hubbardspring.com

Safe Start of a Stored Tractor

All too often, folks rush the process and do actual damage – more precious dollars down the drain!

You main concerns are (1) water in where oils should be - from condensation, (2) multiple contamination and debris issues within the fueling system, and (3) blockage for air-into the engine as a result of critters! (4) The ignition system is generally easy to test and deal with on magneto tractors. Spark is either there, or it isn't!

It is easy enough to loosen the drain plugs for (a) crankcase and (b) main case to see if water comes oozing out. Don't fully remove the plug. Just loosen it and back it out to a point SHORT of coming out. If water is present, you will see it form droplets around the plug. If you just want to hear the engine run, perhaps you won't be too concerned about the rear end.

Water in Places Where Oil Should Be - Engine oil is the main one to think on. Odds are the oil will be quite dirty, and I'd avoid pumping old dirty oil through the engine by purchasing some of the lowest-priced engine oil I could find, and install new oil in the crankcase. And yes, I'd change the oil filter at this time as well.

Ordinarily, one should renew the A519R oil filter cap gasket (O-ring) because odds are that the old one is hard as the Rock of Gibraltar. Filter cartridges are identified in the Restoration Guide (See Subject Index). The O-ring may or may not come with the replacement filter, plus if one does, it may or may not be the right size. If, because you have a very limited objective here, you choose not to bother with the oil filter cap gasket at this stage, just refrain from applying lots of torque to the oil filter cap bolt – this to avoid damage to the oil filter body (See Appendix 14).

NOTE: Assuming you elect to drain the crankcase, if the output is real gooey and just kind of nasty, consider a poor man's flush. Fetching a gallon of cheap paint thinner or mineral spirits. After the "oil" is drained, put the plug back in, then pour in the gallon of mineral spirits. Rock the tractor back and forth a little, then drain into a bucket. You may choose to pour the flush back through a 2nd or 3rd time depending on what you see. I am thinking here of the oil pump -- mesh around it on the bottom of the crankcase can become clogged in a heartbeat, and I'd choose not to make it worse by an engine start without this flush.

Contamination and Debris in the Fueling System - This one is the major one. All eyes turn to cleanliness of the fuel tank, fuel lines, and the filters. Old fuel should be drained from the system, and clean fuel should flow readily. With clean fuel in the tank, valves open and the drain cock of the carburetor open, there should be a steady pencil-sized flow out of the drain cock. You will likely have fueling issues within the carburetor as a result of rust having formed within the walls of the narrow passage ways, mainly on the IDLE side of the carburetor. In the long run, you may indeed need to overhaul your carburetor (See Chapter 8). Then too, the float needle valve may not hold fuel back. When you open the fuel valves in preparation for starting the engine, (if) you see excess fuel in and around the choke end

of the carburetor, this indicates the fuel level in the carburetor bowl is too high - a direct result of float needle valve failure. But - in summary, for a pre-restoration start, just being super clean with the fuel supply should be your main objective. If, when you examine the tank and lines, you see a gummy residue, that's what remains of old gasoline. MEK or lacquer thinner will generally cut through that stuff and is the cleaning agent I would choose for tanks and lines. Be sure to have plenty ventilation when using either one.

Blockage of the Air-Into-the-Engine Path - Drop the oil cup of the air cleaner. What you see will tell you lots. If you see it still has oil, even with some dirt, you will have a favorable find. More often than not, it will be dry and may even contain either water or debris brought in by critters. The other possible issue is dirt daubers having built mud nestings up in the mesh section of the air cleaner. And so, while it can be a big safety issue, I often have the air cleaner cup removed when attempting a first start. Now - this can be unsafe because a belch of fuel can appear there and if ignited, result in fire.

The safer way is to loosen the coupling between carburetor and the air inlet elbow wide enough (say) that you could stick a nickel between the two -- allowing free flow of air into the engine sufficient for a run-up test.

Magneto Ignition - About the only operation I'd perform on the magneto would be to open the distributor cap and do some cleaning. Draw a dollar bill thru the closed contact points to kind of polish them up some. Then check for an "open points" gap of 0.015". Remove any debris, ensure it dry in there, and close 'er up!

While you have the cap off, you may elect to remove the distributing rotor and grasp the magneto's rotor shaft. If you can move up and down, or left and right enough so that you know there is movement there, that's too much. Such movement says that the magneto will eventually need a new bushing or bearing; you see - radial movement of the rotor shaft by only a few thousandths of an inch makes setting the point gap to 0.015" nearly impossible!

Safety Issues – Always have fire-fighting equipment and First Aid articles on hand when working with old engines. In the excitement of the moment, it is far too easy to forget that working with gasoline and magneto ignition can become deadly!

Safety in Practice - When starting, always ensure a turning brake is set, and that the gearshift is in neutral. Also, see to it that the clutch lever is engaged (forward position). This way, if the tractor IS in gear, you will sense it immediately as you begin to rotate the flywheel.

Figure 119. Handstart of John Deere "A"

Additional History/Engine Operation

Production Years - Standing back and taking a more general look at production of Model "H" tractors from beginning to end, the story has some interesting wrinkles. The John Deere Production Year for this era was from July 1st to the following June 30th, with the production year 6-months ahead of the calendar year. For example, the 1939 Production year tractors were built between July 1, 1938 and June 30, 1939.

The First Four Years – Assuming 1939 production began on schedule in July 1938, from then through April 1942, a total of 43561 tractors built during what appears to be a 44-month span of time. On average, output during this period was some 990 tractors per month! This period included all of the HNH and HWH tractors as well! Then came wartime break # 1 beginning 4/30/42.

The Amazing Five Months – The span of time between the two breaks in Model "H" production must have been hectic. Recall, the first break (4/30/42 – 4/28/43) and the second (10/1/43 – 10/12/44). In this brief five month period between the breaks, (4/29 to 9/30 in 1943), a total of 3042 tractors were built for a monthly average output of just over 600 tractors. Also very interesting is that these 3042 tractors were the combined total for production years 1943 and 1944! Included was H-47511 shown on the back cover – a late 1944 tractor. See this tractor's Production Record on page 26.

The Final Years – Well into John Deere's 1945 production year, the "H" factory resumed building tractors on or about 10/13/44. These tractors had a new look with a different drawbar, pressed steel front wheels, and a greater percentage of them had PTO, power lift and electric start when compared with earlier production. During the 27-month run from 10/13/44 through mid-February 1947, 13321 tractors were built for an overall monthly average rate of 493 tractors.

Excerpts from DIR276

Stopping the Tractor -- Disengage clutch by pulling clutch lever clear back. Always place gear shift lever in neutral after disengaging clutch, and engage clutch if engine is idling. This is important as it reduces wear on clutch facings.

Stopping the Engine -- In stopping engine after running on fuel, turn fuel off (control lever down to mark "OFF"). Open drain cock in bottom of carburetor bowl. Engine will stop when fuel in carburetor is used. If engine has been stopped on fuel, see starting instructions.

Overloading -- Your tractor is designed and built to handle economically and efficiently all jobs within its range of power. The use of any tractor on loads beyond its power range results in un-due strain on all parts, and will, if continued, result in unnecessary repair expense and impaired efficiency of operation.

Fig 120. UnStyled & Styled "HN" Tractors

Sheet Metal

Chapter 2

General Commentary -- Your sheet metal can be likened to the body of an automobile. It will make the first impression of your restoration, and a great job here quickly "calms the critical eye". Skillful removal, structural repair, sandblast, prime paint, body work, final painting, and quality decals (Mylar or die cut vinyl, and/or silk-screen) are essential elements here.

A number of critical issues come into play when dealing with a tractor's sheet metal. Serious precautions need to be taken on all matters pertaining to the fuel system. The fuel tank is housed in the hood and must fit just so-so during reassembly because there is so little room to play with. Everything is to be taken into account to avoid leaks; fuel lines are old and delicate thus need to line up with their receptive fittings; fuel caps are in close proximity with the hood and need to be easily accessible once the job is finished. During the restoration process, things will move in relationship to one another. Fit checking is a necessary and continual part of the process as is a pre-paint engine run up to make certain that when, at the last hour, you install a newly painted and decaled hood along with grilles, they go together like clockwork. Once again, preplanning is key.

A Tooling Note -- Skillful removal of parts must be one of your "core values". For sheet metal, wide use is made of 5/16-18 cap screws with No. 3 Phillips Head drive. These cap screws have usually been beaten up by repeated used of worn-out or undersized screwdrivers over the years; or they are set, and the heads are filled with a combination of paint and rust.

In order to minimize complications, three things come to mind: (1) select a Phillips screwdriver to FIT the cap screw (should be # 3; may be something else), (2) grip the screwdriver stem (between the tool end and handle) with a small adjustable wrench (see Figure 201), and (3) ensure the screwdriver is FULLY ENGAGED into the cap screw head and remains so while applying torque (hold it down in there!). Don't forget penetrating solvents and heat as effective aids in the removal process – be careful with heat on thin sheeting. Remember -- Damage NOT done to sheet metal during disassembly is like money in the bank!

If your screwdriver has a round shaft, file or grind a couple "flats" into it such that you can grip it with that adjustable wrench. A vise grip on a round shaft usually doesn't work -- shafts are too hard!

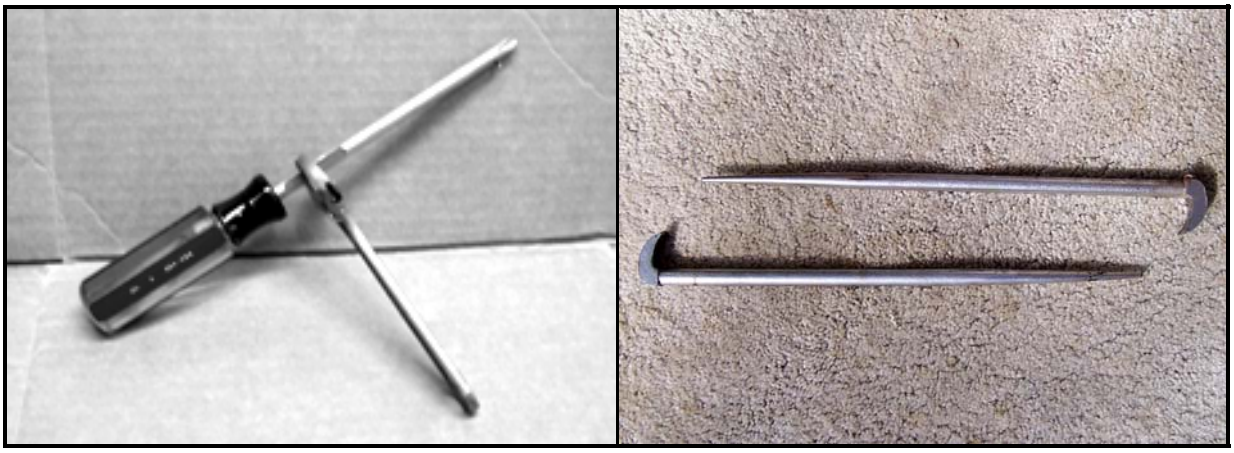


Figure 201(A&B). Husky Brand No. 3 Phillips Head screwdriver (left) with a round shank that has been ground so that this small adjustable wrench will make the "bite" A pair of alignment tools are illustrated on the right.

Removal from the Tractor and Disassembly

Removal Step 1: Drain coolant from the radiator. Also drain fuel tanks. Dispose of according to whether or not these solutions are reusable – usually, they are not!

Removal Step 2: Remove the front medallion, steering wheel, steering worm shaft, and grilles. As parts are removed, accumulate all fasteners and small hardware items in a catch basin or bucket that is partially filled with mineral spirits to act as a mini-parts cleaner.

Fasteners -- Plan to use a new set of sheet metal fasteners during final reassembly. See listing later in this chapter. For all other fasteners, make note of any which are no longer serviceable, procure replacements, and include them with the accumulation - to replace the defective ones.

Removal Step 3: In preparations for hood/tank sub-assembly (S/A) removal, disconnect and remove oil pressure gauge line, disconnect temperature probe from upper water pipe, remove spark plug covers, disconnect ignition wires from magneto and from spark plugs, but leave the wires in the conduit pipe, remove fuel line to the carburetor from 3-way cock, and remove two 7/16-inch diameter cap screws that hold rear tank bracket to the engine block. Once remaining hood screws are extracted, remove the hood/tank S/A. This is an excellent point in time to apply a penetrating agent such as PB Blaster™ to the fasteners remaining in the hood/tank S/A that retain the fuel tank brackets in place and also those for the instrument panel.

Reference Photographs -- Photograph and/or sketch fuel line orientation as indicated by position of fittings. Then, from the fuel tank S/A, remove fuel line and fuel filter. Reference the rear tank bracket; remove wires from the conduit, but not the conduit from the bracket. If you DO separate the conduit from the rear tank support, take a picture beforehand to define the relationship between the two. Use it as reference to remount the conduit. Reference pictures can prevent so much grief during final assembly. This is especially true for things like the combination of the rear fuel tank bracket and the plug wire conduit mounted onto it. See the before and after photographs in figure 202.

At this stage, one would routinely reinstall steering worm shaft and steering wheel for mobility of tractor, and perhaps set grilles, medallion and hood/tank S/A aside as the sheet metal group to be dealt with later on and as separate jobs. This discussion assumes other work will continue on the basic tractor in accord with other parts of this guide, not delineated here. We go on to taking apart the hood/tank S/A.

Definition -- The hood/tank S/A consists of the instrument panel with gauges, the fuel tanks, both tank brackets, and shutter control devices. Attached to the rear tank support is the spark plug wire conduit with wires; all one large subassembly, just lifted from the tractor.

Disassembly -- Having applied a penetrating solvent such as PB Blaster™ or Kroil™ to the hood/tank S/A fasteners beforehand, remove the fasteners to extricate the fuel tanks, rear tank support w/wires, and the instrument panel with instruments intact.

Continue to accumulate fasteners for cleaning, painting and reuse. Remember to bag and tag, and perhaps journal special small items. The B1441R Hood Clips seem to have a way of being lost! Remove and clean gauges and flush fuel tank. Inspect the captive nuts in the hood; renew as necessary.

Figure 202 (A&B). Reference picture shows the relationship between plug wire conduit and rear tank support before disassembly (left). The two parts, separated for cleaning and painting are now re-joined in the same relationship as before (right).

Repairs

Inspect gauges for serviceability, also fuel tanks for inside rust. If fault is found with either the tanks or the instruments, make this the time to perform routine maintenance actions to: (1) renew defective gauges and (2) perform fuel tank repair and relining (if needed) to keep rust out of the fuel system.

Gauges -- Do not arbitrarily discard what appear to be "junk" gauges. You may elect to have the originals restored. See "Gauges" in Appendix 3 to find a vendor. See also Green Magazine Product Review, October 2005. See more data on gauges later in this chapter.

Structural repair -- Any repairs involving a weld, should generally be done prior to sandblast and prime operations. These will include re-tacking welds that have given away, installing new mesh/screen in the grille sections, straightening various hooks or brackets, and restoring or renewing "captive nuts", welded in placed or caged. Replacing those captive nuts is recommended.

When it comes to welding skills, the reader is left to other readily accessible reference books. One not qualified shouldn't attempt welding without proper instruction. If your welding needs are limited and definite, prepare a 'Statement of Work' that includes the necessary illustration, and seek estimates beforehand. In the process of choosing from among local welding shops or fabrication shops, your local engine machinist may also assist in finding this service. Good welders/fabricators are becoming harder to find; at least those of whom - willing cope with the small, odd jobs restoration often brings to the fore.

In sandblast operations, exercise caution because with sheet metal, weakened by rust over the years, it is often easy to "blow holes" in such delicate, thin metal; or warp it permanently. The objective, minimally, is to remove and arrest oxidation of the steel (rust). My practice is to prepare a 'Statement of Work' to the sand blast man, and include caution steps concerning damage to the product. Your statement of work should include pictures of the pieces delivered to serve as an inventory tool – helps at pick-up time!

Grille pieces are usually dented or have damage demanding weld activity such as installing new grille screen material. Do not just rip out all the old mesh. To keep your options open, acquire replacement mesh first and then decide what to cut out and how to lay replacement materials in. All meshes on the market are not created equal. If you have personal experience or know a good source, go with it. And if not, you have Appendix 3, Green and Two Cylinder Magazines, and others; ask questions!

The hood is the centerpiece of the JD "H" sheet metal. It is the biggest piece, the most precious piece. We now see one after-market source – still a costly item. The bottom line is you do the very best to save the piece you have, making needed repairs. It's also the most involved piece to remove and/or reinstall. This means you must "do it right the first time". In addition to obvious body work, there are basic things to evaluate and repair. Repair captive nut holders and renew the captive nuts, ensure the tank straps are complete, still attached, and good for another 50 years of service, and "free-up" the shutter control lever assembly mounted in the hood. Make sure those rivets that hold the shutter control lever are tight. If they aren't, you will eventually see paint chip at the rivet heads – not nice!

Two Cylinder and Green Magazines carry advertisements for after-market sheet metal, or you may also see them on eBay. From time to time you will see providers out there claiming to make your "H" hood like new. Seek and evaluate references before sending any valuable piece away for any purpose.

Body Work and Primer -- Evaluate work needed on sheet metal (S/M) pieces. Make temporary holding jigs or mock-ups as required that support the S/M item during work (see next paragraph). Remove the rust using wire brushes and sandpaper. Light sand blasting is helpful here too. Just take it easy on S/M parts. In areas needing straightening and/or BONDO™, perform the work and apply BONDO™ to bare metal only; then smooth and finish per accepted methods and practices. Use OSPHO both inside and out to arrest rust not reachable. Prepare all five S/M parts for a good coat of epoxy two-part primer; then apply the primer coat. Be sure to chase all captive nuts in S/M pieces using 5/16-18 tap.

Hood Mock up -- Another alternative for your sheet metal needs may be to use a local custom services provider. Build a mock up for your hood and perhaps also for your grilles, and seek a body shop person who will take in odd jobs like these for reasonable rates. If you go this route, begin your search process early! More often than not, such providers take in these jobs as filler, and then for some reason weeks and months may pass and they manage to have no slack time for your job! By starting early and making an occasional visit, you can learn early on whether or not you have selected the right provider. The final outcome that developed for me is interesting. I found a city police officer that did painting on the side for a custom bike shop. Perhaps a good idea is to check with a local law enforcement officer or with local custom bike establishments in search of someone to help you with bodywork and painting!

Figure 203 (A&B). Hood Mockup made using common sawhorse. Note small notch in 2x4 rail on right side to accommodate the shutter control lever (left). Hood mounted onto the mock up. Note use of AH650R Hood support bracket in front, and its orientation & position -- shimmed out from the riser. The AH650R replaced the cross-over piece you see on the left. It will serve as a suitable alternative.

Hood Mock up -- Begin with a basic sawhorse that is nominally 48 inches long. Build up using various short lengths of 2x4 or 2x6 to achieve dimensions described here and in Figure 203C. See short 2x4 cross-members at each end supporting two **rails**; the rails each made of 2x4's some 54 inches long. The preferred method of attaching is by use of 3-inch long deck screws. The rails fit inside the hood, just above the curl or turn-in at the bottom of the hood. The rails will be the reference (in this discussion) for height of the ends. Horizontally, the outside dimensions of the rails will be 10-3/8 inches wide at the narrow (rear) end as they butt into the rear riser, and 17 inches at the wide (front) end where they pass under crossover piece. A close look at the right-hand rail reveals a notch cut to accommodate the B1520R shutter control lever mounted inside the hood. Make the notch 1-1/2 inches wide and centered roughly 16-1/2 inches back from the front crossover piece.

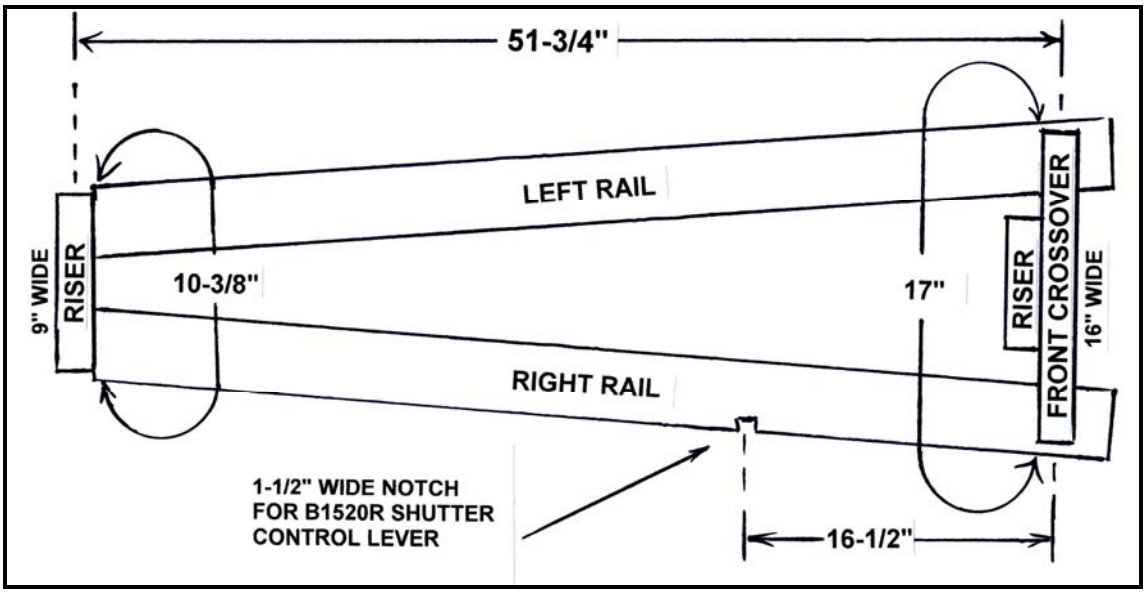


Figure 203C. Top View Detail of Hood Mock Up.

At the rear end, the riser is 9 inches wide, chamfered per hood and instrument panel, and reaches above the top of the rails by 7-1/4 inches. At the front end, the elevated piece is 16 inches wide, shaped and chamfered per **AH650R** hood support bracket, and reaches above the top of the rails by 7-1/4 inches. The on-center (OC) distance between rear riser and front crossover piece is 51-3/4 inches. From figure 203B, you may observe that the AH650R hood support bracket may be used as the front crossover piece.

A closer look at the front crossover piece reveals two 3/8-16 x 4-1/2 inch machine bolts with washers and nuts used to attach the actual AH650R hood support bracket, the interface buffered as needed with flat washers. Secure hood to the mock up using common deck screws, or no. 8 wood screws with small washers, 1-1/2 to 2 inches long is most suitable.

Fit Check

Sheet Metal Fit Check --- This task is to be done after repair work, and perhaps after primer coats have been applied, but prior to final painting of the sheet metal pieces. It doesn't take long. To see all the holes line up without having to "spring" the pieces into position is not only comforting but will save heartache when trying to install those perfectly painted and decaled pieces as your last act of restoration! That's not the time for grief, but for joy! Forcing the sheet metal to fit will eventually result in elongated mounting holes or warping or signs of unsightly stress. And you may end up doing two or three fit checks. You continue to work through multiple trials until you have it right!

For instance, suppose somewhere along this tractor's trail, the front pedestal casting had been removed. Or more probably, during the restoration process itself, the radiator was removed. The key word here is "moved". The probability is high that when reinstalled, the distance of each in relation to the axis of the tractor was changed, and/or the distance between the pedestal and radiator was changed. And just a fraction of an inch can make a great deal of difference when fitting 5/16-18 machine screws to mount the sheet metal pieces. These delicate pieces need to line up! How does one do this? Read on!

The first fit check is noting a relationship between the steering **worm shaft** and **muffler**. Sheet metal is not yet involved. One must have sufficient clearance such that as the shaft is rotated, there is no contact between the two. Even a "really close" situation should be addressed. A no-clearance condition may be resolved by loosening the pedestal bolts and forcing the pedestal to the tractor's right side by just a smidgen, and hold it there until you've retightened its bolts. Another alternative is to shim the muffler mount to sort of "swing" the muffler back and away from the worm shaft. Once this check is completed, remove the worm shaft for now. The worm shaft is to be reinstalled during fit checking the hood and grilles to observe possible interference between the shaft and hood. See Figure 204A.

The next issue is the relationship between the radiator and pedestal, and the way the hood, medallion and grilles are fastened into position. The medallion and front hood support are bolted to the pedestal, as is the forward rib of each grille. The hood relates to the pedestal via the front hood support bracket. The grilles are secured to the hood with a top screw, and then the rear grille screws tie into the radiator side castings!

TIP -- Radiator versus Grilles and Hood -- If the radiator was removed, or just moved during work being done on the tractor, sheet metal alignment can be affected enough to give one headaches. Therefore, it may help to temporarily loosen the radiator mounting bolts allowing radiator position to be tweaked to achieve improved alignment for sheet metal fasteners. Don't forget to go back and re-tighten the radiator bolts.

Alignment of the AH650R front hood support bracket is also critical. If bent from original configuration, it may result in the hood being positioned too far forward, too far to the rear, or even skewed. Any of these will degrade the interface between the hood, grilles, and medallion. Make a close visual check to ensure that this bracket is straight and at a right angle to the axis of the tractor. As it is quite malleable, it can be worked into compliance. Finally, look at the curved interface between the hood and medallion. In particular, observe the relationships between the hood and (1) radiator cap, (2) air cleaner intake, (3) muffler, and (4) steering worm shaft. These will "tell" you what changes, if any, are called for.

One fault I find on almost every tractor is that the hood is high where it meets the steering worm shaft. Be diligent here. Any chafing of the steering shaft with either the muffler or the hood will stand out like a brand on the steering shaft -- not the appearance you seek. I use a long bar. One could use a piece of one-inch water pipe to spring the hood downward where it encounters the shaft. See figure 204A.

The rear tank support bracket very "forgiving" insofar as mounting the hood is concerned. It's more or less a follower, and it *can* be "persuaded" or sprung during the fit-check, and during final assembly!

A last, and most troublesome obstacle to success can be a heavy layering of paint on the hood where the End Cap (instrument panel) is to fit. There can be very little accumulation there if you seek a natural fit. After body work and before final paint, take the time to cut out the excess and again sand to smooth the region in preparation for final paint. Test-mount the End Cap to be sure you have it right.

If major work was done to the hood-tank interface components, be sure to fit the tank assembly into the hood prior to final paint. Have the fuel caps in place on the tanks as a part of this fit-check to ensure they rotate without rubbing the hood!

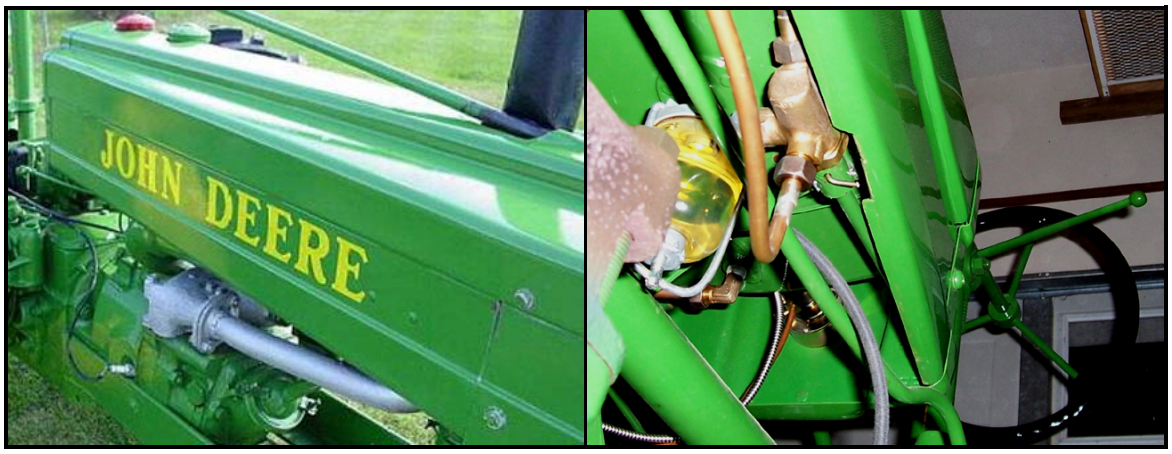


Figure 204

Figure 204. On left, muffler chafing the steering worm shaft; note also wrong sheet metal screws. On the right, AA5334R installed. Notice the notch cut into the hood to enable wrench access to the packing nut on the 3-way fuel cock. This result is driven by the 1/2-inch offset, a difference between AA499R and the AA5334R replacement!

Fuel Systems

Fuel leakage is a condition that cannot be tolerated on any tractor -- ever. Today's fuels will eat away new paint as if they were certified paint strippers! The result is ugly and disconcerting to say the least. For a 60-year old tractor, you can make some quick assumptions like the tank will probably have massive rust inside, and perhaps even some leaks. Even if there are no leaks, near-rust-throughs will result in leaks before long. Fuel lines will be partially if not completely clogged. Filters and screens will be clogged and/or eroded. Shutoffs will not operate. The three-way fuel cock will need a new gasket, and operate with difficulty (if at all). The condition of the fuel caps can range from okay to unserviceable! In any case, make journal notes of all conditions detected so that each will eventually be dealt with. (See new life for the 3-way fuel cock, chapter 6 under "Operating Tips").

Varnish Build Up -- As the fuel evaporates from the float bowl, it leaves sediment, residue, and varnishes behind, which can clog the passages and interfere with the float operations. This is particularly a problem in antique tractors operated for only a part of the year and left to stand with full float chambers for months at a time. Commercial "fuel stabilizer" additives are available to reduce this problem, albeit with limits to its success! One of the very best combination of ways to combat varnishing residue build up in tractors that do nothing for long periods of time is remove the regular gasoline from both of the tanks and from the carburetor. Then install a quart of kerosene (or diesel) putting 3/4 of the kerosene into the fuel tank and the remainder into the smaller gasoline tank. Open the fuel valves so as to flow of the kerosene down into the carburetor, then close all fuel valves. During subsequent startup, simply open the fuel valves and allow all the kerosene to flow out of the system, add gasoline, and start your tractor. All-fuel tractors were designed for these methods, and performed well over the years; more often than not, as the farmer's only tractor! Using Aviation gasoline is another viable alternative – no gummy residue!

AA499R Fuel Filter -- A major source of grief for many is in the Deere replacement for the AA499R fuel filter. To be frank, it IS NOT an exact duplicate replacement for the JD "H" tractor. If you decided to

replace the fuel filter S/A, you need to be aware of two variations in the replacement part that will come back to haunt you during final assembly, one more than the other. Deere documentation defines AA499R replacement as a combination of (1) AA5334R filter plus (2) 29H598R close nipple (1/4-inch NPT).

AA5334R will have a female 1/4-inch NPT entry fitting going into the 3-way fuel cock whereas the AA499R original has a male fitting. Thus is the need for the shortest "close" nipple in town between the filter and 3-way cock. Space is precious here! These two elements must almost touch in the final outcome. But this is not the real problem because if you shop around, you can find a 1/4-inch NPT nipple that's shorter than the item from Deere -- I found mine at a local hardware store. Read on!

In addition to the pipe nipple difference, there is also an **offset issue**. The inlet of the original AA499R fixture is centered whereas the inlet of the replacement is offset. The AA5334R fuel filter S/A will end up closer to the hood by the amount of the offset! The amount is approximately one-half inch, and that offset spells serious trouble during final assembly on the JD "H" tractor.

Noting the tight spacing between hood, the fuel filter S/A and surrounding items, you quickly appreciate the value of that one-half inch – especially so with the Model ”H” tractor! Here, there is no room to get a wrench on the packing nut for the 3-way fuel cock without cutting a notch in the hood! See Figure 204B. Other tractors like A's, B's, and G's have more space and thus the AA5334R with 29H598R nipple replacement works better for those tractors. Had I the slightest indication the replacement was going to grieve me as much as it did, I would have made more effort to restore and reuse the original. With some creativity and some tender loving care, you can clean and polish, then install new packing (made from windings of graphite or waxed string) to make the AA499R serviceable for perhaps several decades of service!

After-Market Sources -- The after-market now includes direct replacements for **AA499R.** Other alternatives may be available as well. For updates, see **www.jdhpubs.com -**- and see *Fuel Systems* for an "**O-Ring**" solution that may hold promise -- so long as it remains on the site. Google “AA499R”.

Frozen AB2805R (AB1545R) Three-Way Fuel Cock -- After you remove that 3-way valve from the sediment bowl, you remove the old D2122R nut packing, reinstall the nut; then use some *heat* on the casting body -- such as laying it in on the coals of your backyard barbeque. Let it cool -- perhaps overnight. They will usually come loose easily thereafter. Some very gentle cleaning of the drum and bore, a new packing a new D2122R packing behind the large nut, and the part should be "good to go". At this writing, D2122R can be purchased from Deere & Co. for roughly $2.00 each.

O-Rings -- From time to time, new information comes available and will be posted on the John Deere "H" Restoration website so long as this author is able. When visiting, look under Fuel Systems. One idea that holds some promise in the arena of fuel leaks for the three-way fuel cock is an O-Ring solution proposed by Jacob Rupp, and is currently posted along with machining dimensions and O-Ring call-outs.

Cleaning -- For each source you will find, you are apt to hear yet another version of the "ideal" cleaning compound for this precious valve. A number of real facts should jump out at you upon first inspection of the valve. A quick price check tells you it is expensive. It is a delicately machined valve with very little forgiveness should you become too aggressive with a grinding compound. The valve has probably been in service a long time and thus will have plenty wear, but the two parts are worn "to" each other. And finally (from experience), do not try a portable drill to "work in" a compound because should a burr form, the valve is quickly lost! What is called for is difficult to find because only the finest grit will do the job -- such as a true jeweler's rouge. Perhaps Brasso™ and a bunch of elbow grease will work here too, but the

outcome eventually depends on your patience and your ability to recall - this is a delicately designed instrument and for continued use, must be treated as such.

Fuel Cap Safety & Gaskets -- All series H tractors us AD709R fuel caps. As engine heat builds, fuel expansion takes place, and with it a pressure build-up that can be very dangerous if opened when hot. Turn the cap over. A close look at the bottom side will reveal two small holes approximately 3/32-inch in diameter on the outer perimeter, and a pair of holes, on a slant, in the center part. The slanted holes open into a drain trough designed to prevent fuel "slosh-out" onto the hood during normal field operations. These holes are the vent system for a capped fuel tank. The fuel cap gasket (D1851R) is sized carefully so that the small outer holes are not covered over. And if you choose to make your own fuel cap gasket, ensure approximate dimensions of 1-7/8-inch inside dimension, 2-3/8-inches outside dimension and 1/8-inch thick. Combination cork and rubber offered in most auto parts stores is suitable in this application.

Fuel Caps

Raised Lettering & Fuel Cap Color -- As with many other parts, we see a part change without a part number change here also. The later version is a genuine John Deere replacement. Part Number AD709R. From the limited data available, fuel caps in the 1930's and for a few years into the 1940' were plain. Later caps carry the words, "BUY CLEAN FUEL" on one half of the top, and "KEEP IT CLEAN" on the lower half. One best guess" is that this change occurred during the 1941-1942 time frame. Eaton Lebow has made those caps and necks for JD and other companies for years and you can get them yourself (www.capsnecks.com) plain (CC-497) or with lettering (CC-3857). For all-fuel tractors (those having a fuel tank and a starter tank), it is very much custom to paint the starter tank cap JD or IHC red, and the main tank cap JD Green.

Restoring a Fuel Tank -- The objective is removal of that gooey, black, sticky gum formation found in gasoline tanks of tractors having been stored for a period of time. Residue and rust can be completely removed, and the rust "halted in its tracks" through a combination of physical agitation and chemical conversion. This process will remove paint and if already painted, the tank assembly will need to be prepped and painted again! Begin by ensuring the tank is free from all material not intended to be a part of the tank! Cleaning is aimed at oil-based residue, plain dirt, and rust. Thus a combination of techniques may be needed. The entire approach to restoring the tank is based on the series of **cleaning, rust-conversion, structural repair,** and **a new liner** if so needed.

Cleaning the tank -- The principle will be to employ a combination of agitation and agents to do the job. Begin with a low-cost degreaser compound and hot water. To remove as much of the rust from the inside of the tank as possible, a number of opinions exist as to how best to dislodge the in-tank rust. Most of them have worked. The basics, however, involve putting some object(s) into the tank to abrade (wear away by scraping or rubbing) and loosen the rust and allow it to be flushed with a solution of very hot water and degreaser. You have to SHAKE, SHAKE, SHAKE and Dump! Use various sized gravel, preferably gravel with sharp-edged stones, to loosen rust particles lodged inside the tanks. And if the

tank's filler tube construction makes you fearful of being able to retrieve all those little stones, a shop vacuum system will do the trick. Some suggest common dog chain because it is much easier to retrieve than (say) rocks! Repeat this laborious step until no further rust is dislodged, and then rinse with clear water.

One enterprising fellow considered picking up a tank filled with rocks and/or chain and giving it a good shake to be darn hard work. So he strapped the tank containing "pea gravel" to the rear wheel of another tractor that was jacked up off the ground. He started the tractor and operated it in 2nd gear for nearly an hour. The tank came clean as "new money"! In another case a man decided to strap the tank onto the front of a cement mixer and it "worked out great!" Here we have two high-powered "rock tumblers".

Removal of Varnish-type or Petroleum-based Residue -- Methyl Ethyl Ketone (MEK) is very effective. Use this compound in a well-ventilated area as its fumes can be toxic if inhaled. MEK can be found in the paints section of hardware and home improvement stores, in quarts or in gallons. Generally, you will need 25% of tank capacity for varnish build-up removal. Add the MEK, include some physical means of agitation like a piece of common dog chain, cap it, swish it around, and then let it stand capped for a half hour or more so it can work. Now you swish and drain. Repeat these steps until all gum formation is removed. NOTE: When closing the tank, use a simple sandwich baggie from the kitchen between the fuel tank cap and tank receptacle. This keeps the cap out of the process.

MEK is a self-drying agent. The tank should be clean. But if non-petroleum contaminants remain in the tank, a hot water and detergent solution is needed to emulsify the debris, so that if can be rinsed away with plain hot water. Water under high pressure (pressure washer) will speed up this step. You can also repeat the process of hot water detergent solution, or cap it and let it sit overnight. Most of the petroleum residue (if any) will turn to a type of primitive soap, and the dirt will deteriorate into simpler sediment, both of which can easily be rinsed out. Repeat rinse until the rinse water is crystal clear--very important!

Removing Old Tank Liners -- MEK or Acetone are both effective in removing "old" tank liners. Use enough to half-fill the tank, then "agitate and set", repeating the steps and setting the tank in differing attitudes (positions) in order to reach all points within the tank.

Rust Conversion -- This step is a treatment to halt red rust. Use a compound containing phosphoric acid, which will convert remaining red rust into iron phosphate, an inert oxide that turns the surface black. One such product is OSPHO, also found in the paint section of hardware and home improvement stores. Add OSPHO to the tank. Close and move tank about to ensure all surfaces are contacted by the solution. Open the tank to dump solution out and allow air in. Allow open tank to stand for a period of time up to 15 minutes. Inspect for red rust. If found, add OSPHO back into tank a second time; repeat OSPHO rinse until no red rust is found. When satisfied that all red rust has been converted to iron phosphate (its black), rinse repeatedly with water until the out-flowing rinse water is clear.

Structural Repair -- Before repairing the tanks, it is essential they be cleaned and rust-converted as above. If you have any solder joint leaks, the tank has been deodorized to the point that it can be safely re-soldered with flame. To repair rust-throughs, JB Weld applied on the tank's exterior regions comes in handy for this. Once you have removed all the exterior rust you can reach, flush the remaining rusted areas with OSPHO™, and after it is cured, wire-brush clean before applying JB Weld.

Cracked Filler Neck Seam in Fuel Tank - Such a defect really should be re-soldered. Radiator shops do this kind of repair. With a thorough cleaning of the tank (safety), you can also renew the soldering yourself. If this is your first try at this kind of thing, however, I do not recommend a "home job". F-I-T tells us, "There are other sealants that might work – such as JB Weld. Another is called Body Seam Sealant, and then there is Liquid Nails – like from Home Depot in a caulking tube. Finally, F-I-T

recommends a urethane-based 3-M product called Scotch-Weld; an aviation grade product -- used to seal fuel tank patches for jet fuel. Sufficient cure time is a key to success." (Courtesy, www.ytmag.com, specifically, http://www.ytmag.com/cgi-bin/viewit.cgi?bd=jd&th=316351).

Commercial Tank Repair -- If trying to repair that old tank is just too much for you, or promises to be an overwhelming experience, there are others you can turn to for gas tank repair. These include your local radiator repair shop, and also help from the web. Google the phrase "gas tank repair" for openers – only to find Moyer Fuel Tank Renu, (800) 328-9550. They make great claims!

Lining a Fuel Tank -- If you've determined the tank must be sealed it with a liner, a thoroughly cleaned, rust-converted and structurally repaired tank are the preparation steps. Part of the tank lining process will be an etch phase followed by a drying phase to prepare the tank surface for the lining compound. There are three popular compounds used for tank liners. They are KREEM, POR-15, and RED KOTE. Do some research before choosing. Internet users may use search engines for each product to learn more. For a typical John Deere Model H tank assembly, one quart of sealer should be sufficient. See product reviews on these products before making your selection. See KREEM process plan at end of chapter.

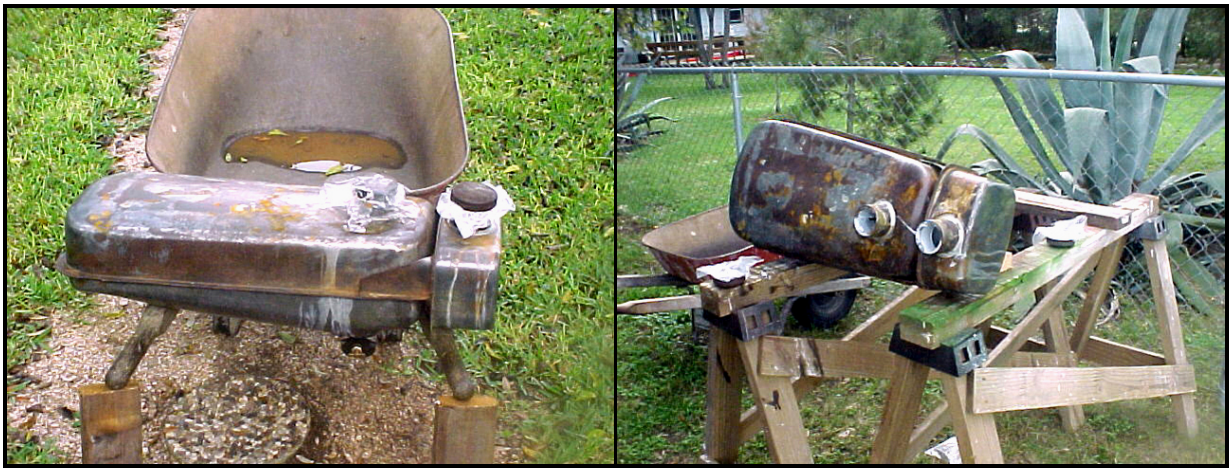


Figure 205 (A&B).

Figure 205. Fuel tanks in a 24-hour etch following rust removal and prior to being coated inside with KREEM tank liner (left). At right, fuel tanks taking in ventilation between "sloshing" exercises during the lining process. Note caps with plastic baggies. This enabled use of the regular fuel caps to close during the "slosh" and yet protect the caps from being coated too – need to keep cap's vent pathways open!

For the processes that follow, one needs suitable plugs for the tank's fuel outlet fittings. I had some regular tank fittings that were unserviceable, and used those. Ordinary pipe plugs will do just fine. Use 1/4 inch NPT for the small tank and 3/8 inch NPT for the main tank. You may have to make a cut-through once the coating process is completed if, when the plug is removed, the new lining has blocked off necessary openings. To close off the filler caps during the lining process, use the regular caps with a plastic sandwich baggie between the cap and tank port. See Figure 205.

You are now ready to proceed with the prescribed lining procedure as outlined by the manufacturer. You must first etch and dry the tank, and then apply the liner. Remember, an underlying principle of this guide is to save you money. You can purchase both the etching and coating products from the manufacturer or you can make your own preparation solutions, and buy only the coating! Read an entire process plan for lining your fuel tanks at the end of the chapter before deciding.

You should allow sufficient time between the coating operation, and pouring fuel into the tanks. A quick check with the manufacturer will give you the answer. The tanks, with fuel caps removed, should be allowed to stand at least two days with daytime temperatures of 70 degrees F or higher, and up to a week for ambient temperatures lower than 70 degrees. Don't rush it.

Engine Run up - Fuel System Check and More

The entire fuel system, once reworked, must be trial-tested on the tractor prior to final paint. Mount the rear tank bracket and strap the fuel tank to the bracket with a ratchet strap or belt, and run all of the fuel lines to their normal destinations. Tighten all fuel fittings without using excessive torque. Those old fittings are so easy to over-tighten, and are so nasty to deal with if you do! A part of the objective for this operational series is to achieve a "no-leaks" fuel system without extraordinary force having to be applied to the fittings.

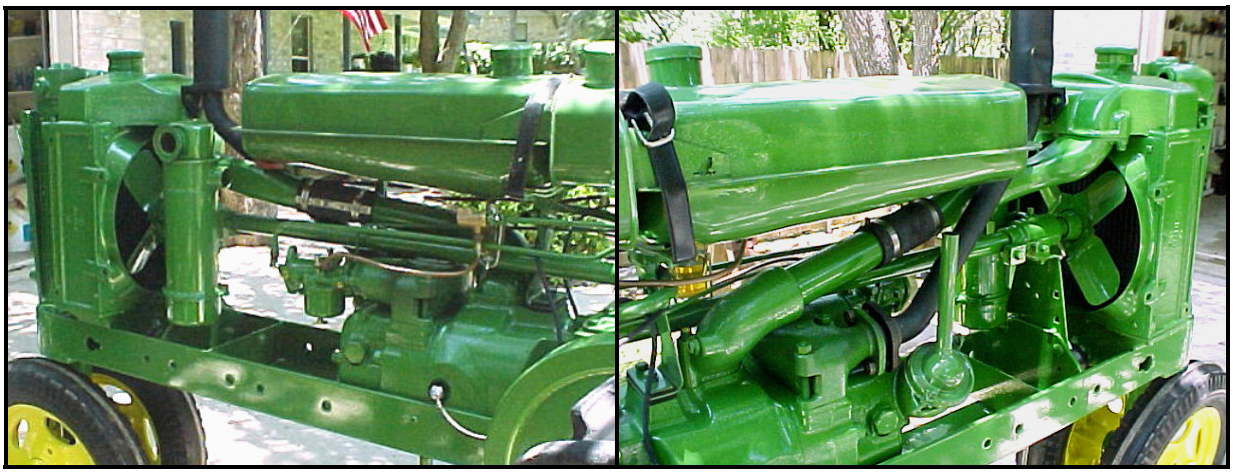


Figure 206. Here we have fuel tank strapped in place & supported in front and fuel lines are attached. Tractor is functional; crankcase oil, radiator filled, and with a temporary oil gauge.

For engine run up you need to have, at minimum, water in the cooling system and oil in the crankcase. This is complicated by the fact that the temperature and oil pressure gauges will not be on the tractor at this time. Therefore, in all engine run up exercises, you must have a 1/2-inch NPT ordinary pipe plug in the tapped hole of the upper pipe (in lieu of the temperature gauge probe and its adapter fitting) to contain the coolant, and a temporary hook up to a "floating" oil pressure gauge.

We continue to hear of folks having to take down an otherwise showpiece tractor because they passed up full engine testing prior to final paint. One may run several engine operational tests prior to final paint for any number of reasons. You will have failures and it is important to deal with them before final paint. I can't over-emphasize the importance of engine run-up tests.

Paint and Decals

Hardeners in both Primer and Paint Coats -- Frequently, successive coats of both primer and paint are applied to sheet metal parts with very little time between applications. And so it is important that when using paint additives like hardeners, to use hardener in primer coats as well. The base formulation of the various coatings being applied must be similar and compatible!

The principal problems resulting from applying primer coats without additives, and then rapidly applying "treated paints" are either peeling away (lifting) of both existing and new coats, or a paint wrinkle; the latter manifesting itself as a sort of withering of the finish. With the tendency for lift, a slight glancing blow to the finish coat will easily bring away a void in your finish paint coat; the result of a part of the undercoat simply torn away! It wasn't cured. It is very disappointing indeed when a beautifully painted tractor hood is suddenly beset with such a fault! See Chapter 9.

There is the age-old discussion among painting gurus whether to use (or not use) hardeners in paint. Proponents of hardeners have found they get a higher gloss with a paint additive, and so they like it! This is reason enough! **WARNING!** Just be prepared for the consequences of ignorance if you choose to use hardeners without first protecting yourself against compounds hazardous to your health. To be advised, see Chapter 9 (Paint) containing expanded discussion on this topic.

Final Paint -- When shooting final paint onto sheet metal parts, items not installed are: (1) gauges, (2) Fuel tanks, lines and brackets, and (3) shutter controls - knob and rods.

Paint Planning -- Be sure to have an end-to-end plan before starting.

Prepare sheet metal surfaces for final paint using varying grits of wet sand paper. For this application, wet sanding is best because there is less accumulation of removed grit on the sandpaper. As a result, the sanding effect is more consistent across the piece, and scratching is less likely. Final prep sanding is done using 600 grit sandpaper. Shoot indoors with ventilation. If shooting outdoors, be under cover to protect against falling debris. Maintain ambient temperature of 75 degrees F or warmer if possible. Use some sort of mockup or jig to hold the pieces. Allow sufficient cure time of painted parts before handling. If hardener is not used, paint cure time is much longer. Be especially aware of your handling and storage needs prior to the shoot.

Gauges -- For the JD "H" tractor, original gauges had white faces which boldly featured "JOHN DEERE" just beneath the scale. The lettering for gauge name or function was smaller, and appeared below "JOHN DEERE". The gauges were already installed by the time the tractor arrived at its paint station. Thus, the painters masked off the glass face piece, permitting gauge rims to be painted green (See Fig. 208A).

The lettering and font sizes for each gauge changed in mid-production. While evidence telling when these changes occurred is limited and may be lost forever, available data indicates the changeover was most likely between model years 1943 and 1944, or even 1945. During a very short five-month period from April 29 through September 30, 1943, both 1943 and 1944 model years (3042 Model "H" tractors) were manufactured between two year-long Wartime Production breaks. And so while evidence points to the 1943-1944 model year break point, a definite point is hard to point out.

The main thrusts of the change were larger, bolder font size for gauge function (name) appearing as the uppermost characters and reduced font size for the "JOHN DEERE" name which now appears below gauge function/name. Gauge faces remained white and rims were painted green throughout production. Figure 208 (A&B) illustrates this change pattern.

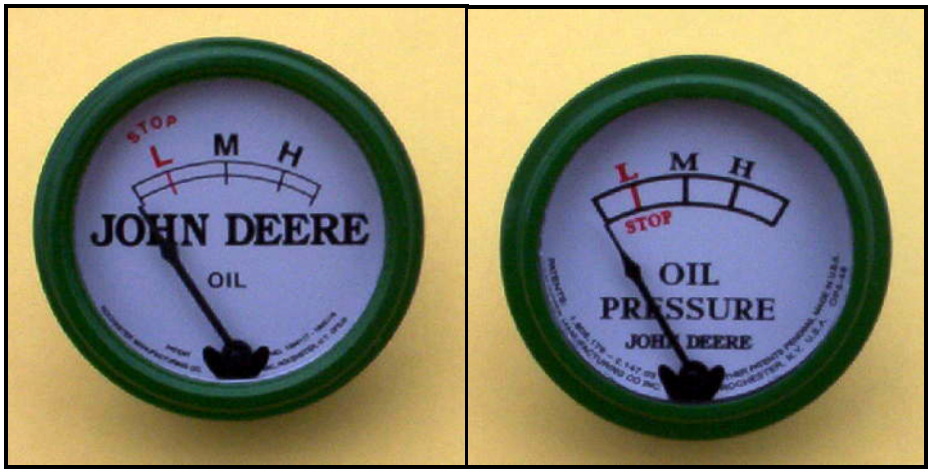


Figure 208 (A&B). Oil Pressure Gauges, Early (left) and Late (right)

For the gauge shown as used on the later tractors, this is the best rendition of what once was! To be sure, there are differences. Many constraints come into play. There were different vendors over the years. Basic gauge construction and technology in today's market is changed. For instance, the indicator needle fulcrum points aren't necessarily where they once were. Such modern day market availability conditions must be worked around, and the picture you depicting the "later" gauge is the complex result of marketplace availability and creative adaptability. This is a **20 pound gauge**. Accordingly, full-scale reading = 20 PSI, "H" is 15 PSI, "M" is 10 PSI, and "L" is 5 PSI.

Decals --- Decals are another element of planning to consider at this stage. Establish a source and choose a type. Then add the application of decals into your Final Paint and Integration Plan. Assuming hardener was used, painted surfaces should be at least one week old before installing decals, at which time final assembly can begin. If hardener was not used, a wait of 30 days to apply decals is recommended. If ambient daytime temperatures are much below 70 degrees, longer cure times are a great idea. Decals are available in both Mylar and die-cut vinyl. As for the choice in decals, the die-cut vinyl type comes highly recommended. This author shopped at Jorde's Decals (JD-licensed) in Rochester, Minnesota, and was superbly impressed with the result.

Vinyl decals are vinyl lettering from sheets of adhesive-backed vinyl, cut by a computer-guided blade. The material around, inside of, and between the actual letters is removed. The result is pre-spaced letters that are sandwiched between a paper backing and spacing tape. Once applied, vinyl decals give the look of silk-screened letters because, in the application process, both the paper backing and spacing tape are removed.

Mylar decals, on the other hand, are letters screened on thin shiny film that demands a super smooth surface for best results. Mylar is lower-cost and fairly durable, but it is generally felt that vinyl decals are a bit tougher, more durable, and certainly more pliable to conform to irregular surfaces.

Applying those precious vinyl decals is the culmination of a great deal of work. Every precaution should be taken to make sure this step goes well. Anything less than this just isn't fair! It sure takes the wind from one's sails to say the least. And to err here is so avoidable. Three sources of guidance are available to you: (1) read carefully the documentation supplied with your decal set, (2) if for any reason, the instructions seem unclear, contact your supplier and talk it out, and (3) visit a local sign shop which sells vinyl signs, and ask for a practical demonstration.

Vinyl decals have pull-away components on each side of the letters. Nothing is pulled away until you have the decal precisely where you want it. Water need not be involved. 1- Position the decal where you want it to be, then place small pieces of masking tape at the top (or along the side for a vertical decal) to form a "hinge" between the decal and the surface receiving the decal. 2- Lift the now-hinged decal and gently remove the adhesive paper backing. 3- Once paper backing is removed, gently bring the hinged decal down into position. 4- Press the decal into place, then remove the spacing tape, and smooth the decal out with a soft, dry cloth and you are done! When working with the longer "JOHN DEERE" decal for the hood, follow the same procedure, but using small pieces of tape to place the decal followed by larger pieces to form the "hinge". Just prior to removing the paper backing, cut the long decal between "JOHN" and "DEERE" and work them as separate decals. Vinyl decals will "breathe" which means two things: (1) you can apply them to your painted surface without having to wait a week or a month, and (2) if you end up with a little air bubble or two, don't sweat it too much. After the sun hits it for a spell, those bubbles will disappear.

Decals are model-year-dependent -- Have your serial number ready when ordering decals for your "H" tractor. Three generations of decals are in existence. For 39 and 40 models, decals are all yellow. For 1941 models, the yellow letters were outlined in black and kept the same size as in 39 and 40. For 1942 and up, the black-bordered letters were squared up some and reduced in size. Accordingly, the decals were shorter. For 39, 40 and 41 models, the rear (differential) cover carried the Leaping Deer decal without a border and carrying the words, "JOHN DEERE, Moline Illinois". For 1942 and up, we have the Leaping Deer decal with border and carrying the words, "JOHN DEERE Quality Farm Equipment". Another new development, beginning with 1941 production, was the issue of two "Safety First" decals; one for safe driving speeds, the other for power shaft use. Your PC304 Parts Catalog will describe these as "Be Careful" decals, this change coming in early 1947. For the JD "H" Tractor, these decals will read "Safety First." "Safety First" decals are inappropriate for earlier (39 and 40) tractors.

Basic Rule – If you receive decals that are not needed Like "H", "Roll-O-Matic", "Power-Trol", or a PTO "Safety First" decal and your tractor has not PTO, do not apply these decals on the tractor anywhere!

Decal placement -- Where to place the decals is generally not that hard to figure out. Use the guide sheet furnished by your decal supplier. For some however, a bit of guidance is added here.

Figure 209 (A&B). Medallion decal on the left, and air cleaner decals on the right.

At the medallion (front nose cone) the 3/4-inch high "JOHN DEERE" decal is placed with its bottom one-inch above the centerline of the single mounting screw. At the air cleaner, the "Service Air Cleaner Daily" decal is placed with its bottom roughly 2 inches above the bowl clamp.

Placement of the "Oil Level" decal should be such that its arrows fall at the embossed oil level mark on the oil bowl of the air cleaner. If your bowl has no embossed mark, set arrows one-inch down from top of the oil bowl. Where OIL LEVEL is embossed in the air cleaner cup, do not apply the “Oil Level” decal.

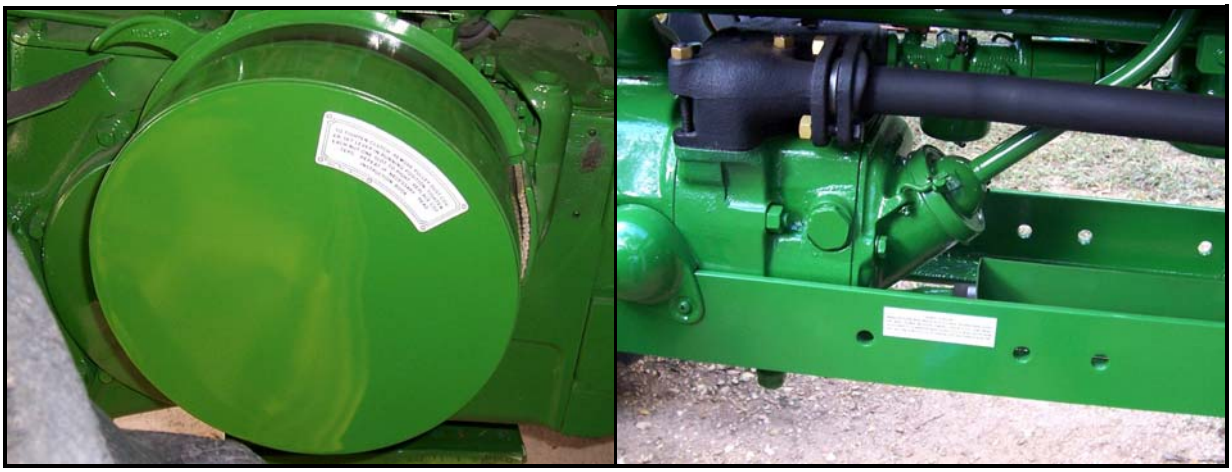


Figure 210 (A&B. Belt pulley (left) and engine breather decal (right)

Figure 211 (A&B). On the left you observe placement of the seat channel (support) decal. On the right is a reference illustration for placing the rear cover decal. Decal is centered (right to left) and also centered between the lines connecting the bottom mounting holes, and the 2nd hole up on each side.

The "MODEL H" decal is placed on the seat support channel, roughly centered in the useable space between the bend and the seat support body casting, P/N H369R. Place this decal reading down. The decal for the rear (differential) cover (JOHN DEERE, Moline, Illinois), or (JOHN DEERE Quality Farm Equipment) is centered side to side. Further, it is vertically centered between two imaginary lines drawn, one between the two lower bolt hole centers, and one drawn between the 2nd bolt hole up on each side.

If you were to imagine just the lower imaginary line, the bottom of the decal ends up 3/4 inch above such a line for the early decal and 1/2 inch for the bordered decal. See Figures 211B and 212A.

JOHN DEERE
QUALITY FARM EQUIPMENT
SAFETY FIRST
STOP POWER SHAFT BEFORE DISMOUNTING FROM TRACTOR.
PROTECT POWER SHAFT DRIVE WITH MASTER GUARD AND SHIELDS

Figure 212 (A&B). On the left, is the later model rear cover decal, JOHN DEERE Quality Farm Equipment. A most discerning observation will reveal that the decal is placed about 1/2 inch too low. On the right is observed correct placement for the SAFETY FIRST decal on the master shield.

"**Safety First" decals, 1941 and up --** Install the Safe Driving Speeds decal on the rear of the seat, just above the center hole. Place the power shaft Safety First decal length-wise on top of the PTO Master Shield: It is to be centered, and read from the left side of the tractor. TIP: No master shield, you don't use this decal! See Figure 212B.

Placement of the "JOHN DEERE" decal for each side of the hood is "completely centered" from all points of view. The decal is vertically centered on the center (depressed) rib of the hood. Forward and aft, the decal is centered on the part of the hood that is visible after final assembly. No reference is made to the screened engine air inlet because it is not in play. See Figures 213 and 214.

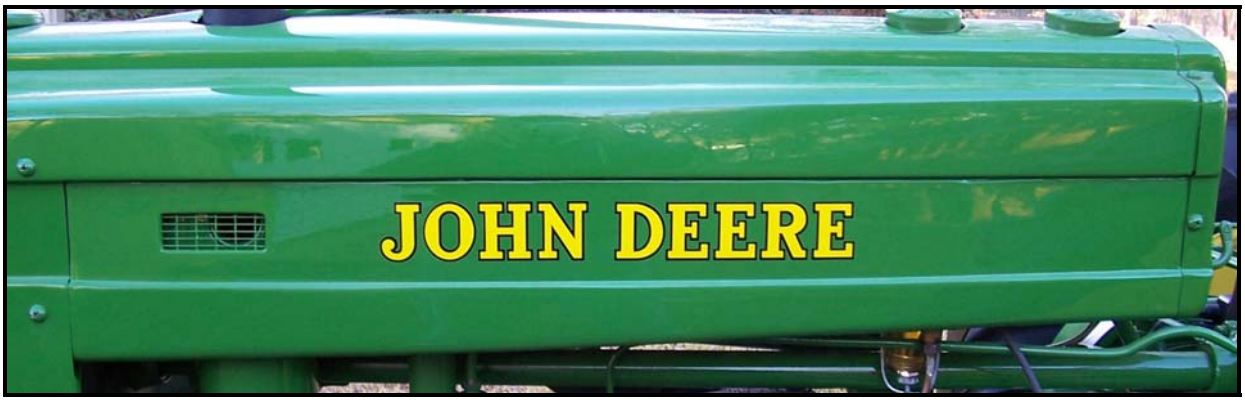


Figure 213. Photo shows the "JOHN DEERE" decal midway (fore and aft) of the exposed section of the hood, and centered (vertically) on the center section.

By the way, if the decal vendor you call doesn't ask you for the year or serial number of your JD "H" tractor, bid them a great day and don't buy there!

Figure 214. This is the pulley-side. As on the flywheel-side, decal is centered fore and aft on the exposed center plane of the hood.

Vinyl Decal Removal -- If you end up needing to remove a vinyl decal, use a hair dryer to heat corners and gently roll or work back the decal. Be extremely patient and gentle. When finished, a really gentle "massage" with ordinary mineral spirits will remove the decal residue without affecting the hardened paint job. This residue can also be buffed off using very fine buffer wheels and a high-speed drive. Obviously, the decal cannot be salvaged! If you get excited and flustered, call the folks who sold you the decals. They know their product!

Assembly of Fuel Tank/Hood/Instrument Panel Subassembly

Allow at least a week of curing time for final paint before final assembly; and up to 30 days if you did not use paint hardener.

A second time, chase all 5/16-18 captive nuts before starting. This S/A will reincorporate the fuel tank assembly and its two brackets, fuel filler caps, fuel filter, 3-way fuel cock and line to small tank, plug wires back into the wire loom, gauges, shutter control knob, and shutter control rods. See photos at the end of Chapter 7. They help to visualize build-up, especially of the forward bracket and B1441R clips.

TIP: (Assembly Note 1): See PC304, page 23, top illustration. The H142R is a felt gasket between air cleaner flange and hood. A good technique here is to use a small amount of automotive trim adhesive or silicone sealant to affix the felt to the air cleaner flange. Or, position the gasket in the air cleaner flange, depress the spring-loaded flange all the way in, and then tie both flange and gasket in position using lightweight string. Perform this procedure BEFORE installing the hood. When the hood is in place, simply cut and remove the string.

TIP: (Assembly Note 2): See PC304, page 22. The AH642R (forward) Tank Support is shown installed with turned rib forward. This is incorrect. Turn the tank support bracket around so that the rib is toward the rear. If you look closer, you will see the hood becoming wider toward the front. Then look at the ends of the AH642R Tank Support. You will be convinced! In addition, the rib needs to be toward the rear to clear the inlet elbow from the radiator on some models.

You will need two or three thick blankets topped by a super gentle cushion to install the tank assembly into the hood, and you will need both visual and touch access to the fuel cap area. Here the environment is almost like working on a mattress! It must be clean and free of any abrasives. The hood unit is cradled upside-down for this step, yet you will have access to the fuel cap area! When mounting the tank

assembly into the hood, be sure to install both fuel caps, and align the tank for the **best fit of the caps** into the hood, and then tighten the bolts for both tank brackets to secure tank in place.

"Best fit of the caps" in the hood are the key operative words. Be aware that those steel straps spot-welded in the hood snugly fit into notches cut into the tank flange. Applying excessive force to move the tank forward or aft may damage the hood where the tank straps are spot-welded in. If necessary, some filing to widen the tank flange notches may be required to achieve that "best fit of the caps".

Then install the two tank fittings, the 3-way fuel cock, and the fuel line between small tank and 3-way cock. Make use of pipe thread sealant (plumber's pipe dope preferred), or Teflon Tape for all threaded fittings and be especially vigilant about alignment of fuel fitting connections. Do not use excessive force, and don't overshoot and have to "come back"! Here is where “before” photo’s come in handy!

TIP: To Change the "Tighten-up" Spot -- More often than not, when installing the fuel filter or three-way cock, the fixture will tighten at a point different from where it must be tight. "Forcing" additional turning for much over 1/8-turn increases risk of damage. One solution is to rent a NPT tap to enlarge the female part of the errant fitting so as to permit the male to turn further into it. For sizes, we have 3/8-inch for the tank and 1/4-inch for the fuel filter fittings. If you have a choice, seek a "bottom-tap".

Turn the tap into the errant female fitting until it tightens (begins to bite). Then take the tap in a small amount, that amount being approximately one-half the added turn you are seeking. Remove the tap, carefully clean the renewed fitting with swabs and oil, and retry the installation using pipe dope as if this were the final operation. If you still lack ability to bring the fitting into final position, repeat the tap and clean plus reinstall process series until the desired result is achieved.

Install all gauges into the instrument panel. For the oil gauge in the bottom opening, you are safe having only mounted the gauge and its 90-degree elbow. On some after-market oil gauges, you must shorten the mounting bolts in order to install the 90-degree bend. Connecting the oil pressure line afterwards is easily done using a small crowfoot wrench to tighten the compression nut. The water temperature gauge will install with its pigtail dangling -- the pigtail will be tied later. Be sure to dress the water temperature gauge lead so it doesn't short out to the ammeter. The wiring harness (electric start) is laid in, and ammeter connections completed during the step below.

Next, one can use a pair of sawhorses with padding on top, over which the hood and tank S/A can be placed, top side up. This position also serves well to mount the instrument panel (with gauges installed), lay in the harness, connect the ammeter, and install both of the shutter control rods (H623R and H625R).

Before mounting the hood S/A to the tractor, the ignition wires should be threaded thru the spark plug cable conduit, all gauges should be in place, and both shutter control rods should be installed, with the up-front (H625R) rod connected to its lever under the hood. Secure those loose and floppy items: the ignition wires, loose ends of the wiring harness, the lead from the temperature gauge, and the small up-front shutter control rod. Ensure the up-front control rod is tied forward. Small cable ties work really well here.

Final Assembly onto Tractor

NOTE -- When placing the tank/hood/instrument panel onto the tractor, the muffler and exhaust pipe can be off the tractor if the tractor does not have electric start. However, be sure to mount the muffler *BEFORE* inserting the steering worm shaft! For tractors with electric start, one may need to remove the generator and perhaps its mounting bracket to gain sufficient working room to install the muffler from under the hood.

TIP -- When mounting the exhaust pipe up into the muffler, ensure there is equal clearance between the exhaust pipe and opening in the bottom of the muffler. Avoid binding the pipe tightly against one side of the muffler opening. Adjust tension on the mounting bolts (loosen one and tighten the other) to relieve binding. Breakage in the weld between the bolting flange and the pipe is prone to occur if binding is allowed to remain (FSB 145-S, May-June 1943).

Guide Bolts, Figure 215A -- use two screws or studs, 7/16 x 2-inch, to hold the bottom cushion and two spacers (Figure 215B) in line and to guide the rear tank bracket into position. Then remove guide screws and install specified fasteners to secure rear bracket to engine block.

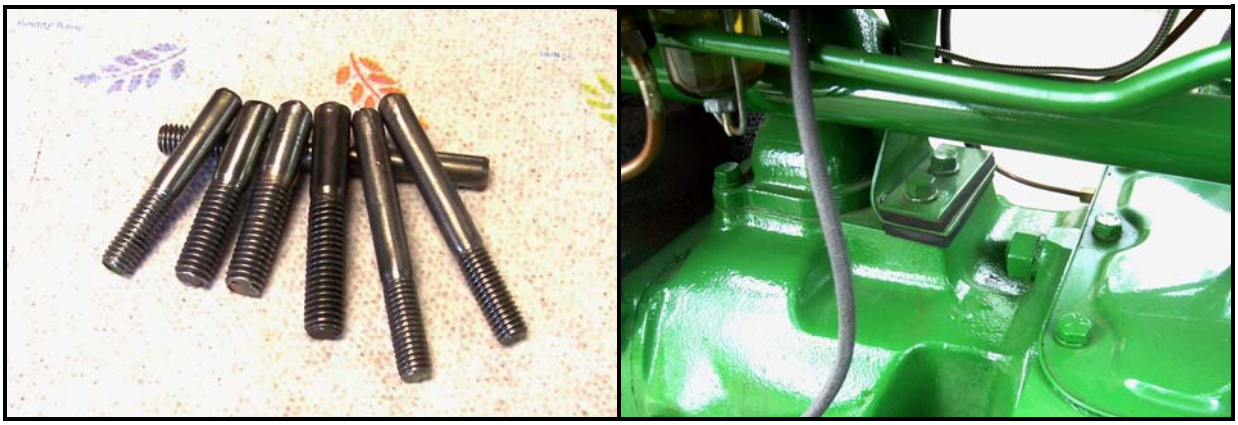


Figure 215 (A&B). Examples of Guide Bolts (left) and the rear tank bracket secured to block

Issues and Warnings -- (1) Use a 5/16-18 tap to re-chase all captive nuts to remove paint, use all new screws, and apply anti-seize compound to screws. (2) Take the bend or spring out of the 5/16 lock washers. Those with BITE will gouge both paint and metal, and that isn't needed here. If used, and you have to back a screw out, the result will not be pretty! (3) If you begin to 'pull a warp' in a grille when mounting the lower bolt to the radiator side casting, STOP! Shim as required between the grille and casting to achieve the desired appearance.

Help Needed -- With the help of two others, lift the hood/tank S/A into position. One person must guide the rear tank bracket down onto the two guide screws. Before one fastener is set into the hood/tank S/A, free up and connect the H625R shutter control rod to the shutter. Also, dress the temperature gauge lead, ignition wires, and wiring harness into position, observing that the temperature gauge lead doesn't make contact with the ammeter posts. Next, proceed with fasteners.

Install the grilles before tightening any fasteners associated with the hood. Loosely install mounting fasteners connecting the grilles and hood, and the hood to AH650R hood bracket using alignment bars as required.

If not already installed, install the muffler now before installing the steering worm shaft. Install the steering worm shaft, its end bearing and cap, and then the medallion.

TIP: At last installation of steering shaft install a 3/4 x 1-inch O-ring on the shaft. The AS568A Standard size is -210 with stock diameter of 1/8-inch. Roll it down far enough that it is not visible from outside the tractor. The O-ring will prevent water running down the shaft and into the steering box bearings.
Yes, the bearing seal should prevent water getting into the bearings and box but it is just another little precaution.

Observe there should be two small pads or cushions between the medallion and hood.

Install the two 7/16-inch cap screws to secure the rear tank bracket to the block -- replacing the guide screws.

Warning -- At this point, begin to draw up hood fasteners being very slow and deliberate. Do not allow the screwdriver to slip which would damage the new (and still soft) paint. Watch carefully when drawing up the side bolts securing grilles to the radiator frame. If you begin to pull a warp in the grille, STOP and install shims to achieve the desired appearance. *You don't want a warp!*

Connect the oil pressure line, main case to gauge, and fuel line between 3-way fuel cock and carburetor; connect the temperature gauge sensor bulb into the upper water pipe, and reinstall coolant. Check for leaks and correct as required.

Connect ignition wires between the magneto and spark plugs during installation of the spark plug covers, and make final connections of the wiring harness (electric start).

You should now be ready to put fuel into the tanks, re-inspect for leaks, and correct as required. Once a pass is achieved here, you are ready for paint touch-up. And the job is finished!

Sheet Metal Fasteners -- Here is a complete list of Round Head (cross-recess) Phillips Head Machine Screws (bolts) for all of the sheet metal parts of your Model "H" John Deere tractor. Reference is PC304 "H" Parts Catalog, Page 21. See Key numbers 9, 14, 17 and 19. The set contains 30 pieces; 26 machine screws and four are mating square nuts.

The breakdown is: eighteen screws 1/2-inch long, four screws 3/4-inch long, and four that are 1-1/4-inch long. The 1-1/4-inch screws are one of those "quarter-sizes" becoming increasingly hard to find, especially at non-industrial, retail outlets. When available supplies are exhausted, if necessary, screws 1-1/2 inch-long may be substituted. See **www.jdhpubs.com** for more information.

Prevention!

Operating TIP - Varnish Build-Up -- As the fuel evaporates from the float bowl, it leaves sediment, residue, and varnishes behind, which clog the passages and can interfere with the float operations. This is particularly a problem in antique tractors operated for only a part of the year and left to stand with full float chambers for months at a time. Commercial "fuel stabilizer" additives are available to reduce this problem, albeit with limits to its success!

<u>One of the very best combination of ways to combat varnishing residue build up</u> in tractors that do nothing for long periods of time is remove the regular gasoline from both of the tanks and from the carburetor. Then install a quart of kerosene (or diesel) putting 3/4 of the kerosene into the fuel tank and the remainder into the smaller gasoline tank. Open the fuel valves so as to flow of the kerosene down into the carburetor, then close all fuel valves. During subsequent startup, simply open the fuel valves and allow all the kerosene to flow out of the system, add gasoline, and start your tractor. All-fuel tractors were designed for these methods, and performed well over the years; more often than not, as the farmer's only tractor!

Fuel Tank Lining Process Plan

Requirements:
1. Industrial strength degreaser concentrate
2. One gallon of MEK
3. One gallon muriatic acid
4. One quart of KREEM Tank Liner

Caution: MEK is very flammable and should be used outside with plenty of ventilation and with a fire extinguisher handy!

Preconditioning: Keep MEK and KREEM in environment where temperature does not drop below 70 degrees.

Procedure:

1. Use very hot water, degreaser (and some metal chain, nails or rocks) into tank, shake, shake and shake! When 'tired of shaking', empty degreaser and chain or nails from tank. The author used 1-inch rocks in small tank, and a short piece of chain in the big one. He also made a hook from 11 AWG gauge wire to fetch the chain from the tank.

2. Perform cold water flush and rinse.

3. Repeat steps 1 and 2 until both wash and rinse water comes out clean and clear.

4. Fill tank with **Prep A** and let stand overnight. The mix going into the tanks is **one gallon of muriatic acid** plus **hot water** for the big tank, and **one pint of muriatic acid** plus **hot water** for the small tank. Check tanks for leaking out of Prep A, and secure leaks if possible at this time. If not, be prepared to replenish as time passes. **IMPORTANT: Always add acid to water ... never water to acid!!**

When water is added to muriatic acid, an exothermic reaction occurs, and is often accompanied by a violent "belch" propelling the acid mixture onto the person making the dilution! Also, never pour acid into an empty container. It can cause dangerous splashing.

The Next Day -- Time is of the Essence!!

5. Empty the **Prep A** etch compound from tanks into plastic buckets provided. Then rinse with clear water, and empty.

6. Dump MEK into the tanks. Have a quart ready for the large tank, and cup for the smaller tank. Shake vigorously, and then dump into metal one-gallon buckets provided. Repeat this step.

7. Go immediately into lining the tanks with KREEM TANK LINER, fill and rotate method.

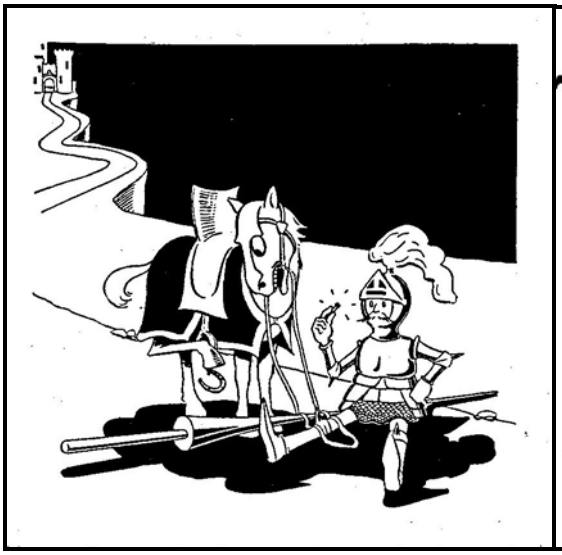
a. Put about 80% of the quart into the large tank and the rest into the smaller tank.

b. Rotate tank into all possible positions, then let tank stand with ports open for 8 - 10 minutes.

c. Repeat step b (above) but with tank standing in different orientations each time, and continue to repeat step b (above) until KREEM TANK LINER is used up, or for two hours, which ever comes first.

d. If there is excess remaining after two hours, dump it into one-gallon metal buckets as in step number 6 above. Allow tanks cure at least two days before attempted use or further rework.

Preventive Maintenance



~~~ Taking Care of Business ~~~

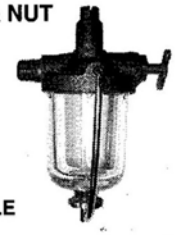
For the want of a nail the shoe was lost,
For the want of a shoe the horse was lost,
For the want of a horse the rider was lost,
For the want of a rider, the kingdom was lost.
All for the want of a horse shoe nail!

From Field Service Bulletin 75-S, July 15, 1937

Part Sources, Fuel Filter & Gauges

Sediment Bowl Assembly & Parts cont...

Sediment Bowl & Bail Assembly **1 lb.**
CAST IRON W/ BRASS HANDLE & NUT
Fits: Unstyled A, AR, AO, B, BR, BO & D; Styled A, AR, AO, B, BR, D, H & G; **COMBINES:** 55 & 65; **ENGINES:** W - WSP
Replaces #AA499R **NEW 2006**
Order #: JDS546
Price: $44.95 **ORIGINAL STYLE**



The following parts fit STP #ABC546 Sediment Bowl Assy.

ORDER #	DESCRIPTION	PRICE
ABC124	Glass Bowl .25 lb.	$3.95
JDS641	Screen .25 lb.	$4.95
JDS642	Gasket .25 lb.	$1.00
ABC236	Bail Assembly w/ Brass Nut .5 lb.	$5.95

Steiner Tractor Parts
(800) 234-3280 -- 2007 Prices

Evergreen Restoration

Evergreen Restoration
Jerry Trcka (without the "i")
W7619 Walnut Drive
Spooner, WI 54801
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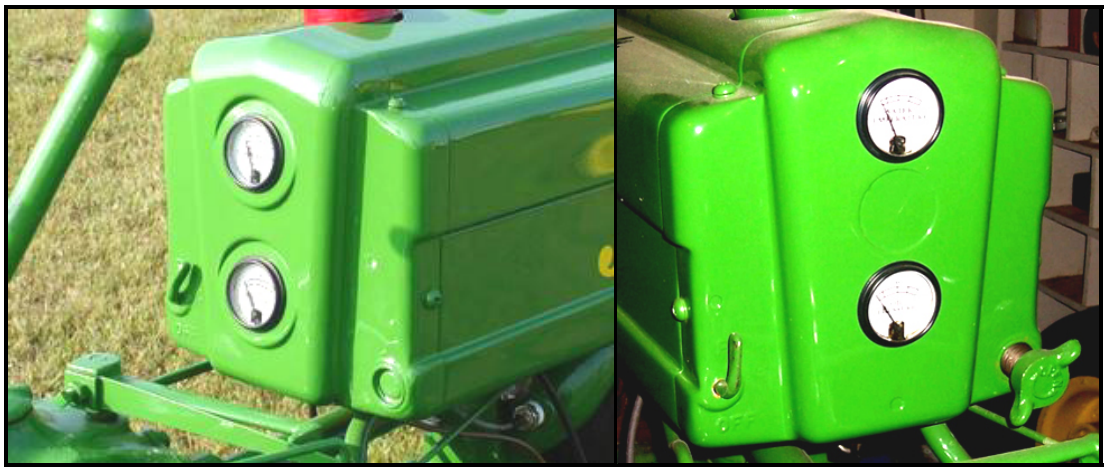
Here & There



Early end cap with shutter plug (left), and later end cap with shutter control (right)

H-200 Series Cultivator (left), and H-3 Plow (right)

Restorer's workshop (left), and why a man needs a woman (right)

The Engine

Chapter 3

General -- Sometimes, the main parts of the engine will be found worthy of continued service as is. More often the engine needs work. Remember your objective. If full restoration is your objective, be more critical in evaluation. In general, rework of the cylinder head will be necessary along with replacement of all gaskets and manifold studs. Evaluation will be much easier if the tractor runs. Before teardown, perform a compression test, record oil pressure and note cooling system performance by monitoring the temperature gauge and looking for leakage. Record all anomalies such as engine smoke, smoke color, and unusual noises like bad bearings. Look for oil leaks as clues to bad bearings and worn out oil seals. Remember to be a super detective! You may even want to prepare a checklist to go by.

Publication -- Engines -- *A Service, testing and maintenance guide for engine systems in off-road vehicles, trucks, buses and automobiles*. Fundamentals of Service (FOS). This is a Deere and Company publication that is well worth spending some time with for the more avid engine rebuilder.

If the engine has recently been overhauled and you have records of this history, perform the verification. If, after evaluating the documents, you are satisfied that the needed work was done, the only remaining reason for going into the engine may be to resolve leaks if any are still present.

➔ ➔ **PROCESS PLANS** ➔ ➔

Engine and Clutch Subsystem Build Up -- This chapter is the first of four to deal with specific, heavy mechanics of your restoration effort. Not contained in the basic chapter are detailed reassembly instructions for the engine and clutch. This activity is supported by **Process Plans** found in **Appendix 5** (crankshaft, main bearings, camshaft and basic engine timing) and **Appendix 6** (cylinder block and pistons, engine head, clutch and reduction gear cover). These appendices contain information you will definitely need. They include torque values as well as notes of both guidance and warning, designed to prevent heartbreak resulting from having made a poor decision. Make copies of them to use as build up instructions and a QC (Quality Control) checklist as you go along. Enter mark-ups and other assembly notes, keeping them as part of your Chronicle to the Journal, or part of the journal itself.

Photographic Memory -- Breaking down a watch and rebuilding it from memory without relying on any form of guidance or illustration is a gift most of us do not have. Therefore, it is good practice to have your Parts Catalog handy during teardown as well as build up (assembly). Identify each and every piece. Make notes of the order of pieces and annotate the orientation of each. Bag and tag the peculiar ones which will include many fasteners, special washers, etc. This is especially important when a part will fit a couple of ways, but that only one way is the right way. **Use your Journal!**

Four Stroke, Four-Cycle Engine -- The engine is a two-cylinder, four stroke cycle (four-cycle) design. The two throws of the crankshaft are 180-degrees apart for balance. Four-cycle operation means the crankshaft must make two revolutions to complete the four cycles of Intake, Compression, Combustion and Exhaust. The No. 1 cylinder (flywheel side) combustion stroke (fire) is followed by the No. 2 cylinder combustion stroke 180-degrees rotation of the crank later. This 1-2 punch of power strokes is followed by 540 degrees crank rotation without combustion, the heavy flywheel carrying the engine all the way. This pattern of two fires in rapid succession followed by a full revolution of the crank without fire results in the put-put or di-dit sound pattern of the two-cylinder John Deere tractor. Ignition is provided by an impulse magneto, addressed in Chapter 7, Electrical Systems.

Second Cylinder Starvation During Idle -- This timeline of 1-2 fire, then a 540-degree coast, forms the basis for "second cylinder starvation", a phenomenon where the fuel-air mix drawn by the pulley side

(No. 2) cylinder is more lean than that which was drawn in by No. 1 when the engine is idling. This is considered a design deficiency by some, later corrected by dual-barreled carburetors, but much later -- attesting that (in fact) this was not a pressing problem for JD tractor users. These tractors were built for pulling, not idling. As one writer pointed out to me, it is interesting to note that John Deere never did much bragging about the idling characteristics of their two-cylinder tractors! He goes on to say that (to him) it is not a deficiency but rather an idiosyncrasy to be appreciated and considered part of the unique flavor of these old gems of this nation's agricultural heritage! I must say, however, that in an engine having marginal readings of compression, and/or ignition problems, second cylinder starvation becomes a bit troublesome in starting, idling and under a load. Misfire and plug fouling accompany this condition, and further degrade engine performance.

Bore and Stroke -- The cylinder bore is 3-9/16 inches in diameter and the stroke is 5 inches providing a total of 99.7 cubic inches total displacement. New engine compression is specified at 80 PSI, and the compression ratio is 4.75 to 1. The JD "H" is a 12 to 14 HP tractor, nearly 1/2 the workhorse of it's Model "A" counterpart of those production years. I have always thought a pull-off employing two JD "H" tractors at once against the JD "A" tractor would be interesting to see!

Engine Lubrication System -- Oil is forced under pressure through the oil filter by a pump. Filtered oil is then forced through oil lines to the main bearings, and through drilled leads in the crankshaft to connecting rod bearings. The overflow of oil, which is forced out around connecting rod bearings, is caught by the revolving crankshaft and thrown to cylinder walls, bathing governor gears, camshaft, and other parts in the crankcase in oil. Oil is pumped to the tappet case to lubricate and cool valve stems, rocker arms and tappets. And an oil pressure gauge providing the real time reading is in plain view for the operator. See Appendix 14 for continued, expanded discussion and analysis.

Ventilated Crankcase -- Crankcase ventilation is built into the engine. Air is drawn into the frontal breather pipe, filtered through the oil-soaked moss, and then circulated through the crankcase, carrying all vapors to the top of the governor housing. Suction created by the engine draws the crankcase gases through the ventilation pipe, where they are mixed with the air entering the carburetor. The gases are then drawn through the combustion chambers and exhausted. Using a radiator shutter (or curtain) to keep the engine at operating temperature (190°F or better) is super helpful in moving crankcase fumes out. The objective is to prevent moisture condensation, which helps form sludge; thus keeping engine oil cleaner. Cleaner oil will prolong engine life.

Air Filtering System -- The oil-wash air cleaner removes dust and dirt from the air that is drawn into the engine. The body of the filter unit is filled with closely crimped wire screen; the bowl at the bottom contains oil. The suction of the engine intake draws the incoming air into the cleaner and through the oil. Air and oil are drawn up into the closely crimped wire where the dirt is arrested in oil. Only clean air is allowed to pass into the engine. Every time the engine is shut off, the dirty oil drains down into the reservoir (bowl) at the base of the air cleaner where the dirt and dust settle out of the oil. It's an easy job to remove the bowl for cleaning, after the engine has been shut down for a short time.

Air Filter, Cleaning the Wire Mesh -- The objectives are: (1) to remove all dirt, and (2) to leave an oiliness in the mesh when finished. Submerse the oil-bath air cleaner canister into a solvent such as kerosene in a 5-gallon bucket for a soak period, then swish up and down. Re-soak and re-swish as needed to remove dirt. Try pressure washing for more stubborn dirt or for removing mud dauber nests. If dirt remains, steam cleaning is the ultimate answer. Allow the unit to dry. Once dried and cleaned, rinse again in kerosene. Then pour some clean engine oil through the mesh after washing to provide the mesh that "oiliness" quality it needs to do its job. DO NOT REMOVE WIRE MESH FROM CANNISTER!

Carburetion -- The JD "H" carburetor is natural draft, single barrel with throttle diameter of 1.25 inches, and adjustable Idle and Load jets that can be set by the owner. The Idle circuit is totally separate from the Load circuit. The complexity of the Idle path is likely to challenge owners now and again because these carburetors are roughly six decades old. Carburetors for the JD "H" tractor were DLTX-26 for H-1000 through H-26,999 and DLTX-46 for H-27000 and up. The only difference between these two carburetors is in the choke; hand-operated for DLTX-26, and remotely controllable for DLTX-46; the latter of the two accommodates an electric start option. The manifold intake passages are very short; thus the fuel is drawn downward a short distance from the carburetor through a compact, heated manifold where it is gasified. It is then drawn into the combustion chambers and transformed into power before it has a chance to re-liquefy. Per 1939 promotional materials, John Deere claimed each of the two cylinders were equidistant from the carburetor, thus each receives the same amount of fuel. See *Chapter 8*, Carburetors.

Cooling System -- The cooling system is built on the thermo-siphon principle wherein hot water rises over cooler water. As a result, the coolant circulates automatically without the need for a water pump…less parts to cause trouble. There is no thermostat to stick and no fan belt to slip. The coolant does not begin to circulate until the engine is hot enough to burn the fuel properly -- the circulation then keeps pace with the cooling requirements of the engine. Horizontal two-cylinder engine design has enabled John Deere engineers to place the engine on the same level as the lower part of the radiator so that the cool water enters the water jacket around the exhaust valves first. This is the hottest part of any engine, where cooling is needed most. A radiator curtain or shutter enables you to maintain this temperature under varying weather and work conditions. A water temperature gauge, located in plain sight from the tractor seat, tells you when to adjust the curtain or shutter.

Antifreeze -- When adding antifreeze like the conventional green coolant such as NAPA brand prepared for NAPA by the makers of PEAK, strive to avoid having all of the antifreeze in the bottom of the cooling system. Don't just pour the antifreeze in first! Mix! Mixing antifreeze with water before pouring the mixture into the radiator will prevent development of an "antifreeze block" in your cooling system. In your JD "H" tractor, heated water will rise over unheated water because heated water has a lower "specific gravity," i.e., it is not as dense, thus lighter in weight. This "automatic circulation" does not happen until water in the lower part of the coolant jacket (engine) is heated to achieve this "less dense" state so as to rise. The specific gravity of "regular" antifreeze (such as PEAK) is 1.12. That is 12% heavier than pure water! Its density is not known to change much with temperature, and it will NEVER become less dense than pure water. So, if the lower half of your coolant jacket is filled with pure antifreeze, it just WILL NOT rise over water, meaning that you may have NO circulation! The temperature gauge reads HOT, yet the upper radiator tank is COLD. If this happens, drain, mix and then reinstall the mixture into the tractor. Caution: Never drain coolant from a super-heated engine; **just shut it down and let it cool**.

50-50 Premix -- For most of us, we are accustomed to purchasing "ordinary permanent, ethylene-glycol" type antifreeze which, when mixed with equal amounts of water will protect your cooling system to minus (-) 34°F. Recent attempts to buy this product reveals the same massive proliferation of antifreeze products as one would find when looking for hotdogs in your grocer's cold goods case! First off, there is a very popular 50-50 premix, then there are long-life, extended life, and "dex-cool" varieties. At Wal-Mart, I found Prestone 50-50 premix for sale at $8.00 per gallon, and store-brand full-strength at $9.00 per gallon. Both products make similar claims in terms of protecting your cooling system. But buying the premix nearly doubles your cost! One advantage, however, assuming you want to end up with a 50-50 ratio of antifreeze to water, buying the premix deletes the concern for "antifreeze block" as discussed above. Assuming you live in the South, and need only a 20-80 mix of antifreeze-to-water, then buy the full strength, then mix at a rate or 20-80 **BEFORE** filling your tractor's coolant jacket. The procedure is to drain the current cooling system's contents, reinstall drain plug, and then add the premixed solution.

New 5-yr Antifreeze -- DEX-COOL™ is a protected name for GM's version. DEX-COOL™ is super sensitive to exposure to oxygen and atmospheric carbon dioxide, so unless your cooling system has a pressure cap and an overflow tank (closed system - no air pockets), this substance shouldn't be used. Many are saying that the organic compounds in the DEX-COOL™ attack the radiator solder alloy and leach out the tin leaving the lead behind. During the heat/cool cycles the lead begins to break down and allows the joints to pull apart. They go on to say that repair is nearly impossible because of the chemically-altered solder that remains; plus erosion of the copper or brass surfaces. Vintage tractors were constructed when lead-based solders were very cheap and brass was the first choice material for cooling systems. Times have changed and so have the construction methods and materials. Yesterday's tractors get along very well with the older glycol coolants because they were very well tested through the years and have proven themselves over time. The bottom line -- **I would never use any of the new 5-year antifreeze compounds in my two-cylinder John Deere!**

Governor -- JD "H" tractors use a flying-weight design to control engine speed over a wide range of varying load conditions. This is accomplished via a fairly simple relationship between the governor shaft and throttle lever. Most speed-control troubles are a direct result of binding linkages or improper linkage adjustment between the governor and throttle. The assembly is lubricated by a line from the oil pump.

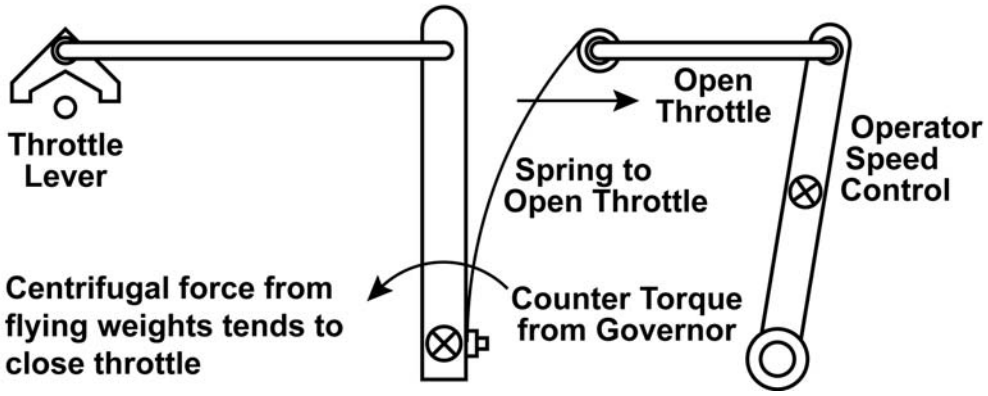

Throttle Lever
Open Throttle
Spring to Open Throttle
Operator Speed Control
Centrifugal force from flying weights tends to close throttle
Counter Torque from Governor

Figure 300. Schematic Diagram, Typical JD Governor

Seals -- Leaky oil seals are heartbreaking, and can be avoided by a simple rule. All seals are to be renewed, whether or not their associated bearings are replaced! Another item to watch for is any special restrictions (on assembly) designed to protect that new seal -- such as the H631R retainer in the rear axle assembly. Oil seals and grease seals have a flexible lip that rubs against a shaft or housing to prevent the leakage or ingress of fluids. Some oil seals and grease seals have a spring to help keep the lip in contact with the shaft. For proper installation, the seal lip should point towards the medium being contained.

Felt Washers and Oil Seals – Felt washers are used in lots of places on the tractor, but they will be found only where field dirt and dust could enter a bearing. Their principal purpose is to block entry of grit. On the other hand, oil seals are used to prevent this lubricating fluid from spilling out onto the ground! Both are used throughout the tractor, but seals are not generally exposed to grit from the outside world.

Damage to either seals or felts can be traced to several causes to include sloppy workmanship during installation or build up. However, the most likely cause is bearing wear and a lack of preventive maintenance. Deere made wide use of supporting a rotating shaft using a pair of TIMKEN (tapered) roller bearings with a stop for each one, adjustable by use of shims. The usual adjustment criteria; that the bearings are to be compressed just short of keeping the shaft from turning freely. This is called "bearing load". If this measure is met, there will be no radial movement of the shaft! It is the radial

movement of a shaft that kills seals and felts. The result will be noisy operation and, in the final drive, oil seeping out at the end of the axle housing.

Paper Gasket Sealers -- During reassembly, use of non-hardening Permatex 2B (or a suitable alternative) is useful for all paper gaskets and also some cork gaskets because the old surfaces to be gasketed have deteriorated. Besides, they weren't perfect to begin with. Other sealers are worthy of consideration to include Permatex Hylomar HPF, Permatex Aviation, Loctite Hi-Tack, or products from VersaChem and JB Weld. I like Permatex® Aviation Form-A-Gasket® No. 3 Sealant on the gaskets mating the radiator core to tanks, and upper water pipes to either cylinder block or top radiator tank. Apply in moderation, and cleanup is a snap if using mineral spirits, and if done within a few hours after applying.

Warning! Using full grade 5 bolt torque values to draw fasteners on paper-gasketed surfaces when the gasket has been doped with gasket sealer will most likely result in **failure** because the sealer will act as a lubricant permitting the gasket to slip out (be squeezed out) from between the two mating surfaces. With pressed steel covers, a "snug draw" that stops short of distorting the piece is sufficient. For heavier casting applications, employ a force that stops short of squeezing the gasket from between the two pieces.

Cork Gasket Treatment -- The experiences of others combined with my own tell us NOT to let them get slippery from oil, and don't use silicone sealers on them as they have a tendency to slip out, or slide around during installation. If the cork gasket is old and dry and appears to have shrunk, try a brief soak in hot water to re-expand it. Time-tested methods included brushed-on shellac for a sealer. Many today will use a product like Permatex Indian Head shellac gasket sealer, and/or any of the other sticky brush-on type Permatex sealers.

Gaskets, A Unique Observation – A seasoned diesel engine technician states (on www.ytmag.com), "Why use a gasket in the first place? If mating surfaces are clean and flat, then apply a thin bead of gasket eliminator by Locktite ™. Gaskets are of the past. Gaskets leak. By using gaskets you are adding one more connection to leak. Gaskets also compress and in time will loosen and leak. The only exception would be in a shim application. Modern manufacturers are using fewer gaskets all the time." Unfortunately, the mating surfaces in a Model "H" tractor are generally NOT flat and thus gaskets ARE needed when performing an overhaul! Courtesy, http://www.ytmag.com/cgi-bin/viewit.cgi?bd=jd&th=348058

Gasket Pretreatment -- For head gaskets, the service manual still states to soak them momentarily in engine oil prior to installing. Many in today's "community" are recommending a spray-on gasket sealer containing copper to aid in heat conduction and fill minor surface irregularities, and most importantly seal! Manufacturers include Permatex (Copper Spray-a-Gasket) and K&W (Coppercoat). Experts say that applying a couple light coats of regular aluminum paint also works well. The key is to proceed with assembly before the paint dries. The best insurance against leaky head gaskets is flatness of the mating surfaces and tightening stud nuts to the correct torque. The torque wrench ensures adequate tension and guards against over-tightening. It is recommended practice to start the engine and run until normal operating temperature is reached. Check for fuel, oil and coolant leaks. Stop the engine, then retighten all stud nuts to the correct torque (FSB 201, March 1953), and recheck tappet settings after re-torque (FSB 49-R, 5-15-35). For head gasket orientation, see Appendix # 6.

Soft Washers – Use of lead washers on cylinder head studs is to serve one purpose, lubrication. They keep the nut from galling into cast iron head – which, if happens, will provide false torque readings. You can use either copper, aluminum or lead. They are NOT used for sealing.

Seal Retainers and Shims --- New replacement parts for most seal retainers are no longer available. During disassembly, it is wise to treat shims as if they were precious -- because they are! Take special

care when separating castings. Avoid inserting a screwdriver or small pry bar between the two castings in an attempt to force them apart. When shims exist between parts, such tool insertion can wreak havoc with those old shims. Rubber mallets come in handy, and verify all fasteners have been removed!

Replicate. Return parts found to be serviceable to their exact orientation and location -- during reassembly. If you ever took notice, mechanics in days gone by would drill a series of holes along a yardstick as a holder for intake and exhaust valves. This would serve to keep valves in order as they were being removed for a valve job. If the valves were found repairable, they went right back (after grinding) into the same valve guide from which they were removed. Similar control methods were applied to pushrods. They would arrange them in a rack so that they would go right back into their original home locations and point in the same direction! This was also done for connecting rods (especially babbitted rods), rocker arms, ball bearings, shafts, gears, etc. **Why?** Because those parts have developed wear patterns with their mating elements. If they are interchanged, that wear has to be started all over again. If the part is replaced with a new one, that was that. There's little one can do about it. You just return the rest of the parts to their exact location and orientation as they were found. Think on this: if you and another each had a really comfortable pair of shoes, would you like to swap used shoes with him?

Thrust Washers -- Every one of these special washer-like bearing surfaces plays a vital role. Some have special shapes but most are flat. Some are thick, some are thin. They may be referred to as spacers, shims, thrust washers, or just plain washers. But thrust washers are specifically called out to counteract special forces. Be mindful of their need! They are found throughout the tractor from front to back; in the steering linkage, engine, transmission and differential. Having any parts like these "left over" at the end of the job is a sure sign of trouble. Be sure to journal, "bag and tag" every thrust washer, spacer and shim that you encounter during tear-down. During build-up, have your PC304 Part Catalog open and in plain view for use as an illustrated parts breakdown/"goes into" chart. The key word is "illustrated". Leaving a thrust washer out during build up would be a costly error.

Torque Values -- Appendices 5 and 6 provide step-by-step process plans for building the engine up for installing ringed pistons into the block, the block with pistons and rods onto the tractor and into the crankcase, along with the engine head, manifold, and valve control devices. For each step, critical torque operations must be performed, and the values for torque of connecting rods, engine head and manifold are clearly stated. See also Appendix 2 for a (general) torque values table.

Compression Testing -- It is wise to perform a compression test and record the readings for your engine prior to tear-down. This information can become useful in troubleshooting during build-up. See "compression testing" in Chapter 6.

Inspection Criteria -- Evaluation of individual parts of your tractor is an ongoing event. Recall that renewal or restoration is the removal of wear. Be vigilant therefore of wear and tear evidence, and for any other result that makes the tractor not new. Be sure to **journal** your findings!

Inspect bearings for missing balls or rollers, rust pitting or corrosion pocks on bearing surfaces, and for wear or deformation of the separator cage. Look for a general smoothness, firmness of assembly, and freedom of movement for all bearing parts. Check bearing cups for smoothness, and freedom from cracks, pits or pocks.

Inspect bushings and shafts for wear, fit and cracks. A snug fit and freedom to rotate are the basic requirement for bushings. Look for missing bushings (Your parts catalog comes in handy here).

Engine gears must not have missing teeth. See Appendix 7 for more guidance on gears. Uneven tooth wear needs to be traced for cause and the cause cured. Over 25% tooth width loss is a turning point

beyond which replacement is generally warranted. There shall be observable, or discernable backlash, but only enough to be discernable to the touch. Backlash in the case of the fan shaft-governor interface will be discussed later in this chapter under “Governor and Fan Shaft Interface”.

Inspect threaded parts and fasteners for "riveting", cross-threading and burrs. All must meet the original specifications or be replaced. Standard torque values and specific torque call-outs assume NEW THREAD conditions, i.e., clean and undamaged threads.

Submit engine castings to rigorous testing, looking for wear, abuse or misuse, and most of all for cracks. At a minimum, these will include the main case, cylinder head, block, pistons, manifold, carburetor, connecting rods, main bearing housings, and all castings that contain radiator coolant.

Every single item of hardware in the tractor right on down to yoke and clevis pins must be examined with a reuse or replace decision made for each. See Appendix 7 for expanded inspection criteria.

Cylinder Head -- Design is valve-in-head, no push rod sleeves, and valves seated directly into the head casting. Guides for both intake and exhaust valves are interchangeable; replacements (as needed) are pressed into the cylinder head casting and reamed to fit valve stems. **Tappet Lubrication** - Engine oil is pumped to the tappet area and is dripped onto the exhaust valve stems ONLY. Push rods, tappets intake valve stems, and all other components in the tappet enclosure are lubricated with splatter. **CAUTION –** if oil is dripped on the INTAKE valve stems, some of this oil is drawn into the engine – and a “blue smoker” is the result!

Within "the community" we find a vast amount of discussion about failed head gaskets, but far less on valve condition and the impact of a failing valve on two-cylinder engine performance. One valve failure is HALF the engine! Therefore, be especially watchful how valves are seated in the cylinder head, and how they are fitted in their guides. These are enormous parts of engine restoration.

Once into teardown, take the engine head to an automotive type machinist for rebuilding. **NOTE**: Begin well in advance of your "need date" in terms of getting this job to an engine rebuilder. Reworking your tractor's cylinder head may require a special set-up. Bottom line -- knowing a skilled person to do the work and then allowing him time to "work your job in" will bring you the best overall result.

Statement of Work (SOW) -- Prepare a SOW detailing the work and testing you want done. Attach tech data to the SOW regarding valve seating, valve stem clearance, and valve spring pass/fail criteria. Do your homework! The machinist may suggest added criteria; be prepared to discuss it at the first meeting. Minimum requirements are a thorough cleaning, inspection for **cracks,** a standard valve job, ensuring flatness of mating surfaces, and (if required) a light 'facing' of the gasket interface surfaces. Above all, never leave engine parts with anyone other than to one who will do the work; avoid “Send Out Agents”!

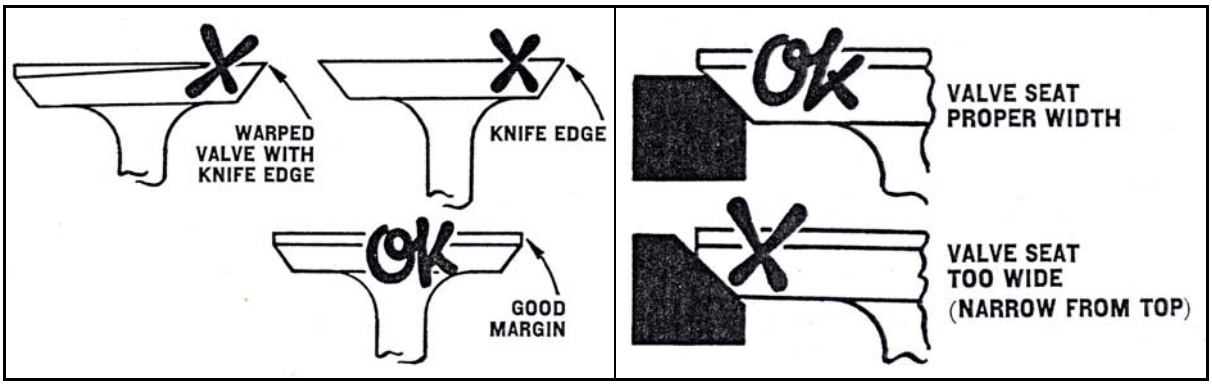


Figure 301 (A&B). Valve Head Margins *and* Valve Seat Width

Standard Valve Job -- Any valve not having a definite margin all around its perimeter is to be replaced. Whether from warp or excessive wear, a knife edge will be ground on part or all of the valve head. (See Figure 301A). Mass is required in a valve head for strength and to dissipate heat. Knife edges lead to flame turning over the edge and burning, and to pre-ignition due to heat localizing on the valve edge. There is a tendency to grind seats too wide when reconditioning. The valve seat must always be smaller than the valve face. (See Figure 301B). Seats too wide collect carbon and seats too narrow prevent the valve head from rapidly dissipating its heat, leading to valve burning. **Be critical of worn valve guides**. Intake guides with too much clearance admit air and oil into the combustion chamber, increasing oil consumption and making heavy carbon deposits. Sloppy exhaust guide clearance causes misalignment and bad seating, resulting in fast valve and seat wear. Make sure valve guides are clean before taking measurements. Springs that are distorted, rust-pitted, have been severely overheated or that fail pressure testing must be replaced. (FSB 139-S, 11-15-42).

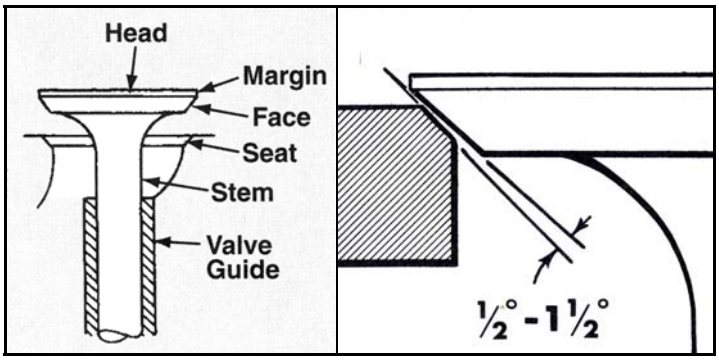


Figure 302(A&B). Valve Nomenclature (Fundamentals of Service - Engines by Deere & Co) and Interference Angle (Sioux Tools, Inc.)

Check Valve Seating -- You should remove the valves from the head when you get home to check how they seat. They should seat in the top half of the valve face with appropriate seat area, and there may be a small interference angle between valve face and valve seat. (See Figure 302B). To check valve seating, stand the valve upside down on its head and use a No. 2 lead pencil to make slash marks approximately 1/16 inches apart all around the valve face. Place the valve in its valve guide and while pulling it against the seat by the stem, turn it approximately 1/4 revolution. **Do not turn a full revolution because if there is a high point on the seat, it will mislead you in thinking it is seating all around the face.** Remove the valve from the head and check the area on the face to see where pencil lead has been wiped out. There should be no voids!

Manifold – This casting will have eroded – losing much of its cast body. There are reported instances of holes between the intake and exhaust chambers. Such a defect wreaks havoc on engine performance, and is extremely hard to find in a built-up engine. A thorough cleaning and some probing around inside the casting may be revealing and should be done. Sandblasting is an excellent way to prepare casting for complete visual checkout.

Powder Coat and Brass Nuts - As an added touch, you may choose to have the sandblasted manifold powder-coated to Gloss Black. Many small automotive "fix-it" type shops offer this service at a very reasonable cost. Then follow this up with brass nuts – limiting torque to 35-45 ft-lbs!

TIP: To remove corroded manifold nuts, pour water on them. Allow the water to run down around the threads for a few minutes. The nuts can then be removed without the usual hazard of seizing to the studs (FSB 121-S, 5-15-41).

Removing Old Studs from Castings – Key elements are heat and a clean-biting vice grip wrench. Some welding may be called for as well – depending on circumstances. Heat the existing stud (it sticks up) cherry red; if you lack a part sticking up, its welding time. Either weld an extension onto the stud, of position a nut over the hole and half-fill it with weld to join stud and nut. These treatments, once cooled enough so they are no longer red, should give you something to grasp – and your success rate should rise to 100%! All that remains is to chase the hole and blow out debris.

Stud Depth – Studs are used to attach one casting to another. The *lengths* of these studs securing manifolds, cylinder heads and blocks are called out in your PC304 Parts Catalog to within 1/8-inch. It is wise to follow this guidance. **Stud ends usually differ**. The blunted end has a slightly large diameter thread and is to be inserted into the casting. The nut spins easily on the other end. As a general guide, the stud depth into the "first casting" shall not exceed 1.5 times stud diameter, (STANDARD HANDBOOK FOR MECHANICAL ENGINEERS, Seventh Edition).

Example – Install manifold using 7/16 x 4-3/8-inch studs w/nuts. Apply anti-seize compound to the blunt end of the studs, and turn them into head not more than 5/8 +/- 1/32-inch (1.5 times diameter). Resultant stud extension should be approximately 3-3/4 inches up from engine head.

Drain Fitting --- One other issue with John Deere two-cylinder engine heads is serviceability of the drain port. It is not uncommon to find that the 3/4 inch NPT fitting is reamed or wallowed out so badly that a corresponding drain fitting will not reliably fit. Two solutions come to mind here. (1) Borrow or rent a 3/4 inch NPT Tap. Once you have a "bite", take it about two turns more and chances are that you will have a new set of threads. (2) The alternative is to have the drain port over-bored and tapped to receive a 1 x 3/4 inch NPT sleeve reducer. You may choose to ignore the sleeve reducer and simply use 1 inch NPT nipple and cap. Either way, it will then be good for another 60 years!

The Crankshaft and Main Bearings --- Many people are filled with fear and trepidation as they contemplate removal of the engine block and pistons, the crankshaft and its main bearings. The best advice I can give is that you take a lot of pictures and write notes along the way. There are a small number of gaskets associated with the main case that are generally found to leak. Remove the crankshaft, inspect journal and main bearing surfaces. Remove the camshaft to inspect the shaft and its bearings plus the pulley bushing-camshaft interface. Journal your way through this! During the life of the tractor, the operator is instructed to always have the clutch engaged unless changing gears, thus the pulley is turning with the camshaft. When the clutch is disengaged, the pulley is stopped but the camshaft continues to rotate. If the operators always followed instructions, you should find the pulley bushing and pulley bearing in pristine shape! But do not count on it.

During tear-down, evaluate the crankshaft, its main and journal bearings, wrist pins, piston rings, and cylinder walls for excess wear, scoring, or any other abnormalities. The machinist will have the skill and tools to gauge the amount of wear found, and whether the wear is even or elongated. Nominal diameter for both mains and journals is 2.0615 inches. Seeking "machinist help" from an automotive engine rebuilder during this step is recommended. **Take your Service Guide with you. He WILL need it!**

Crankshaft Thrust Washer Discussion -- During build-up, use process plans provided and PC304 for illustration. The "H" tractor employs a thrust washer on the left (flywheel) side between the crankshaft and L.H. main bearing housing (fits into the housing), but none on the R.H. side. Be sure you do not leave it out! If one side is worn so it is rough or uneven, install thrust washer smooth side toward the crankshaft. Reasoning -- full pressure from the engine oil pump is exposed to the right end of the crankshaft. The end of the crankshaft is 2-1/16 inches diameter, and calculations show the end of the crank has an effective surface area of 3.341 square inches. Engine oil pressure directed against the end of

the crankshaft forces the crankshaft away from the R.H. main bearing housing just like a hydraulic jack's piston is forced outward from internal hydraulic pressure. For the "H" crankshaft, the force is only 33.41 to 50.12 pounds, depending on engine oil pressure (10 to 15 PSI). There is nothing to counteract this force except the thrust bearing against the L.H. main bearing. Apparently, Deere & Co. engineers felt that this constant, hydraulically-created force would negate the need for a thrust washer at the R.H. main bearing.

Connecting Rods and Bearings -- On tractors H-1000 through H-21499, connecting rod bearings are a shimless, steel-backed, babbitt lined, non-adjustable, slip-in, precision type "shells" which can be renewed without removing connecting rods from the tractor. For working clearance, however, it is necessary to remove the tappet lever push rods. **NOTE: Connecting rods can be replaced with the later type, which have integral "spun-babbitt" shimmed type bearings.**

On H-21500 and following, connecting rod bearings are of the "spun-babbitt" shimmed type. Renewal of the rod bearings is accomplished by removing rods and installing "rebabbitted" connecting rods.

If there is any question as to whether or not a connecting rod is straight, it should be repaired or replaced. Competent engine machine shops will have the ability to check rod straightness and press them back into alignment. It is also critical to look for out-of-roundness of the bearing surfaces on the rod. To do this, use an inside micrometer to measure the circle at right angles with the bearing cap bolts installed and torqued. Elongation over 0.001 inch is generally not acceptable and may cause your bearing to lock up

Figure 303 (A&B) Cylinder Wall with Pitting, No. 1 Cylinder, and Ring Gap Observation

tight even though the plastigage measurements check out during assembly. A symptom of a bent rod or of elongation wear will be that the crankshaft will have points of unequal resistance during its full turn.

Carefully watch for instances where the crankshaft will not turn easily when you have the bearing and piston assembled (on either or both sides).

Torque of Connecting Rods -- The bolts for the connecting rods are torqued to **62-1/2 ft-lbs.** Insert cotter. If cotter will not insert, tighten further to enable the cotter to enter through a slot of the castellated nut and spread its pins. If your tractor uses self-locking (**as in Marsden Type**) locknuts in place of castellated nuts, use new ones during rebuild – do not reuse any kind, whether nylon slug, pinched, etc. Use of self-locking nuts is normally for inserted type rods, and not generally used on babbited rods.

Trial and Error Method -- During reassembly, adjust connecting rod bearing **running clearance** to a value from 0.001 to 0.003 inch. Adjustment is by use of shims in attaching connecting rods to the crankshaft. Remove all the shims (one rod at a time) and measure the top and bottom stacks with a micrometer to ensure they are equal to start with. The thin shims are 0.003 inch thick. Install connecting

rod with shim stacks and torque. If there is no binding or halting in crank rotation, remove 1 shim (top and bottom) and repeat until binding occurs. If there is binding, add 1 shim (top and bottom) and repeat. If it spins freely, you are good to go! **NOTE**: This trial and error series is much easier to perform "on the bench", prior to installing the crankshaft and the rod and pistons units into the main case.

Plastigage™ -- Plastigage is easier and more accurate in setting running clearance and is available at most auto parts stores. The size to buy is determined by running clearance which is approximately 0.003 inch for the JD "H" tractor. Plastigage is an inexpensive impregnated string that squishes when you insert a piece (use about one inch, held in place with bearing grease) between the journal and bearing shell then tighten the bolts. Match the width of the "squish" against a chart on the packet to make the measurement.

TIP -- For a complete rebuild, the plastigage measurement can be done on a work bench prior to assembly and installation of the crankshaft, pistons and connecting rods.

TIP -- Preset (or cement) the bottom connecting rod bolt so that it cannot retract on you. Attempting to deal with loose shims and a moving bolt at the same time can be a major problem. The "preset" operation can be done with a dab of JB WELD™ under the bolt head, torque it and let stand overnight.

Figure 304. Wrist Pins, one is serviceable, one needs a closer look

Plastigage and the Torque Wrench -- The general instruction: "A torque wrench should be used to ensure the rod bolts are tight for each trial, and the crank is not to be allowed to rotate during this test".

For the JD "H" Tractor however, use of a torque wrench with "no rotation of the crank" is not a workable combination. Thus, draw the bolts up really tight. Use a box end wrench on the top bolt and a small socket and ratchet (with short extension) on the bottom one. Once drawn tight, open the bearing, and examine the image left in the grease. Measure its resultant width against a scale on the package to determine operating clearance. Then, take this value to determine the shim adjustment required to bring the clearance back to specification. **Never turn the crankshaft during this process.**

Limits on use of Plastigage -- The gage works quite well when your crank has been machined; it is round. If that is not the case, clearance measured by this method will depend on whether you happened to place it on a low or high point on the crank. A key check is that the crank rotates a free 360 degrees after each rod is tightened with no tightness or binding! When finished with the first rod, you may choose to loosen it a bit while working the second rod. This way, you can be sure that when looking for free rotation, you are examining only one rod bearing at the time. For an unturned crank, use Plastigage to get close, then the trial and error method to finalize this adjustment.

Engine Block and Cylinders – Your engine block may have been cracked as a result of either freezing or overheating. Testing for cracks and for flatness of the block-to-head surface is essential. More than likely, the water jacket of the block will be laden with minerals and iron oxide. A thorough cleaning by a service vendor to remove the possibility of a concealed defect is a necessary first step to this test.

Aside from cracks and warps, the remaining deficiencies will be pitting of the cylinder walls and/or out-of-roundness. If "machinists tolerances" are violated, overbore is the single-most suitable alternative with the "H" engine block. JD engine blocks are not normally sleeved. They are blessed with plenty of iron and can be successfully over-bored to 0.090 inch. Caution: If the machinist fails to ask you for the pistons you are going to use, and for the skirt clearance, find another machinist! For reference, standard cylinder bore is 3.562 - 3.563 inches with 3 - 6 mils skirt clearance. These data are found in the Condensed Data Section of your Service Guide, and on the last page before Chapter 1 of this volume.

If your cylinder measurements are within acceptable tolerances, and you choose not to rebore, it is imperative that any piston ring ridge at the tops of cylinders be removed with a ridge reamer. If there is any perceptible ridge, it may damage new piston rings during installation.

Once the amount of overbore has been determined, procure the new pistons, rings, pins, and perhaps rods. Then, ONLY when these new items are in hand should the machinist perform the work to include block overbore and fit rods, wrist pins and pistons together. **Take all these items plus your service guide to the machinist**.

Far too often, I read a grief-stricken message posted on Internet discussion boards where a block is bored to one dimension and either the rings or pistons are of another! If you have purchased either rings or pistons of a dimension different from the one you and your machinist agreed upon, the machinist will detect this and (per the SOW) call you for clarification BEFORE he cuts into the block!

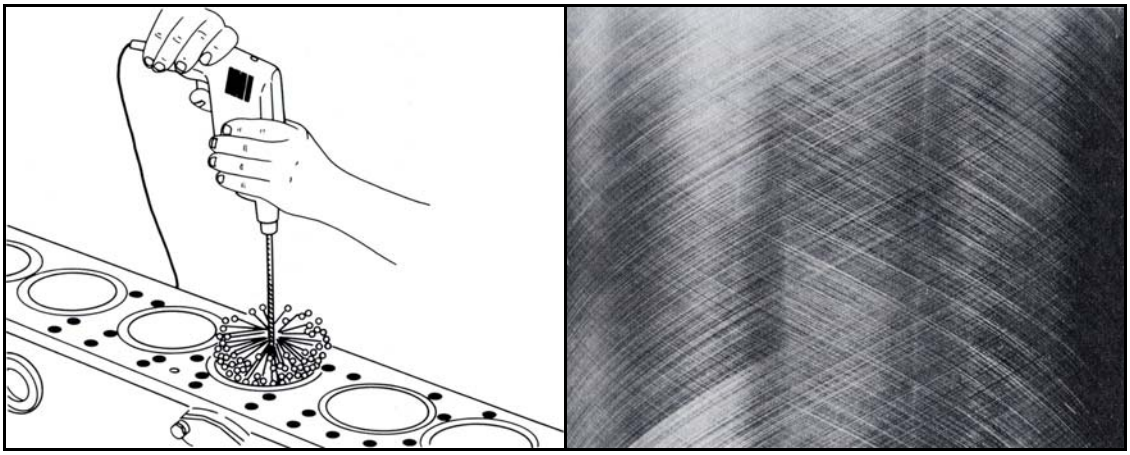


Figure 305(A&B). Deglazing Tool (Ag. Power & Machinery - with permission granted by Billy Harrell) *and* **Crosshatch Pattern (Dana Corp)**

Cylinder Wall Deglazing -- If cylinder bores are serviceable, use 220-280 grit deglazing tool or cylinder hone to remove the glaze from the bore. The glaze (glass-like coating) must be taken away in order to seat the new rings. Use plenty of light oil while deglazing to encourage debris to flow out and to lubricate the grinding stones. Remember: **Enlarging the bore IS NOT an objective here**!

WARNING -- Small home-use drills run way too fast! If you insist on using your small, quarter-inch drill, it must be variable in speed, and you must operate as SLOW as the drill will go! Try about 100 to 120 RPM with the drill! **SLOW IS THE KEY!** If you are unable to resist just "grinding away" with a small drill-operated hone, do it by hand. Get a piece of fine grit (280-340) Emory cloth and manually deglaze in accordance with the pattern above. You will know you are done when you arm gets tired!

Deglaze (or hone) the cylinder wall for about 15-20 seconds while stroking up and down at a rate of one complete up and down stroke per second (as in tick-tock for up-down). Withdraw tool from cylinder bore while it is still turning. Coordinate up and down stroking and tool RPM to achieve a 45-degree crosshatch pattern as shown. Too steep an angle promotes oil migration down the cylinder, and can cause ring and cylinder scuffing. Too flat a crosshatch angle can hold excess oil which causes rings to hydroplane resulting in excessive oil consumption.

Most Critical Step -- When finished, wash the bore with soap and water until it is "**white glove clean**". The residue, if left in the engine, will rapidly degrade moving parts. After cleaning, oil the area to prevent rust formation.

Piston Pins and Bushings -- Also referred to as **wrist pins**, the pin diameter is called out at 1.104 to 1.105 inch for the "H" tractor. You should have a thumb push fit in the un-bushed piston and have a clearance of between 0.0002 and 0.002 inch in the connecting rod bushing.

Piston Orientation -- There IS a top-side and a bottom-side to JD pistons. Most of them will be marked "TOP". If yours aren't marked this way, or you just can't find the mark, then examine the oil ring groove. You will find a short series of holes on one side of the piston that extends half way around the oil ring groove (or land). Orient the piston with these holes UP.

Piston Ring Side Clearance – This is the clearance between the piston ring and the ring land, and relates to the difference between ring thickness and the groove width in the piston. A new ring in a new groove will have approximately 0.0015-inch clearance. The old Instructions and Parts Lists (IPL) (Dir. No. 214, 248, and 276) state the following: "When the piston is held in a horizontal position and revolved slowly, piston rings should fit snugly, yet be free enough to fall of their own weight." The SM states the suggested side clearance should not exceed 0.005-inch for compression rings, and should not exceed 0.004-inch for oil rings. The IPLs also state, "When ring grooves in pistons become worn excessively, loss of compression and high oil consumption will result. The pistons and rings should be replaced."

Piston Ring End Gap – End gap is important because the ring needs room to expand. Without sufficient expansion clearance, scoring of the cylinder wall or a broken ring may result! For proper break-ins, end gap should be a minimum of 0.003-inch per inch of bore. Engines that will work hard and hot immediately after overhaul need 0.004-inch minimum of end gap per inch of bore. Service manuals call out a range from 0.015 to 0.025-inch end gap for both compression and oil rings. As a matter of interest, the range of 0.012 to 0.016-inch is called out in DIR214 for the 1939 "H". Equally interesting is the fact that this clearance is not referenced in the subsequent IPLs, (DIR248 and DIR276) as the wording was changed to state, "New piston rings are provided with proper end gap. No fitting in cylinder is required." Per FSB 95-S (3-15-39), ring gap for all rings is not to be less than 0.015-inch. This measurement is made by first inserting a cleaned piston into the cylinder to about the center of the stroke. Then, place the ring against the head of the piston to square the ring, and measure the gap with feeler gauges. Common sense dictates that regardless of the source of your new rings, John Deere or an

aftermarket supplier, you should always check the ring end gap just to be sure. If the ring end gap measures less than the prescribed 0.015-inch, place the ring in a cushioned vise and use a fine file to open this gap. Be careful: don't take away too much, and work "square" to maintain square ends.

Ring Groove Cleaning -- Use a ring groove cleaning tool to remove carbon from grooves before installing new rings. Be very careful to avoid removal of parent material from the piston grooves. John Deere "H" tractors have all-fuel engines designed to burn distillate, and as such will have pistons with three compression rings at the head end and one oil-wiper ring on the skirt end. Original pistons will also have a groove machined around the head end to collect carbon. The groove, commonly referred to as a carbon groove, acts as a heat dam to reduce heat transfer to the top compression ring. When cleaning the ring lands, do not remove the carbon deposit from this ring. (Ref SM2004, Oct 5, 1948).

Piston Ring Installation -- Ring installation instructions are generally provided with the product by the manufacturer. These instructions should be read each time that you prepare to install rings on the pistons. In lieu of instructions, we have four general guidelines, courtesy of Hastings Manufacturing Company: (1) rings having a "dot" on the side of the ring must always be installed with the "dot" towards the TOP of the piston, (2) rings with a "bevel" on the inside diameter but with no dot must be installed with the "bevel" towards the TOP of the piston, (3) rings with a "groove" in the outside diameter and no dot must be installed with the "groove" toward the BOTTOM of the piston, and (4) rings having no dots, bevels, or grooves can be installed either way. Observe very closely. Those "dots" may be only faintly visible! IMPORTANT: A ring expander should always be used. Manual installation of rings onto the pistons may result in a distortion commonly called "snaky rings", leading to high oil consumption. Be sure to oil pistons, rings and cylinder walls.

Where should ring gaps be positioned on the piston? Deere literature for the model "H" does not appear to address this issue. It is not discussed in any of the early IPLs, nor is it mentioned in the SM. Because rings have the capability of rotating during service, some say that gap position is unimportant. However, to minimize cylinder leakage, it is prudent to avoid positioning the gaps in a straight line. Even though compression losses are quite small through a ring gap, such losses do occur. If the gaps are staggered, such blow-by is diminished because of the labyrinth seal effect created by the maze-like path that gases must travel to escape through ring end gaps. Authoritative references, such as piston ring manufacturers, state that staggered rings minimize the possibility of cylinder scuffing when an engine is started for the first time. Automotive service manuals almost always mandate staggered ring gaps, and many manuals even show illustrations that dictate the specified location of each ring gap.

Reusing old Rings and Pistons! Don't do it! They invariably result in a smoking engine, because dropping the rings back into untouched cylinder bores will virtually guarantee that they do not seat. Honing the bore to encourage ring seating will usually make the piston-to-bore clearance so large as to cause various other oil control and ring sealing problems, again leading to smoke. There's no reason to go through the time, effort and expense of rebuilding an engine if you're going to skimp on something that costs less than $100. Reusing old pistons can be just as bad! Ring groove wear is but one factor. Next, look at the caliper measurement of the sample piston. Usually, you will see that it is oval-shaped. Pistons are oval shaped from side-forces caused when the piston pushes back on the connecting rod, which is always at an angle during the power stroke.

Main Bearings -- Bearings are one-piece, non-adjustable precision type bushings now obsolete at Deere, but are generally found in the market place on an exchange basis in the main bearing housings. To renew the main bearings: open crankcase and disconnect main bearing oil lines, unbolt and push the piston with connecting rods forward, remove flywheel, main bearing cover, and flywheel spacer; after which the left main bearing housing can be removed. On the right side, remove the clutch and belt pulley and reduction gear cover; after which the right main bearing housing is loosened and moved back and/or removed. The crankshaft can now be withdrawn from crankcase.

Crankshaft -- While a bent crankshaft is unlikely, it is possible. If you aren't getting a rebuild but rather having your shaft turned or welded and turned, the straightness will be determined for you during the turning process. Nonetheless, when you get your freshly welded and turned crankshaft back, examine it very carefully for imperfections in the surfaces. Surfaces should be smooth as baby's skin and reflective as a fine mirror.

Crankpin Polish -- If minor scoring is present, you may polish with good quality silicon carbide or emery cloth backed sanding belt stock. I recommend using 400 or 600 grit wet-dry, used with light oil for wetting. Sources: bearing and seal houses, and fastener stores sell this type of product to manufacturers and engine rebuilders. Roundness is the primary quality you are looking for. Egg-shaped wear is common with these journals, and if elongation is found, having the crank turned may be the wisest choice.

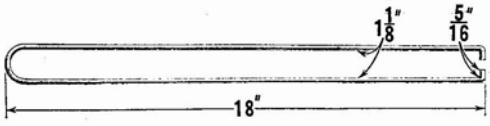
Symptoms of lack of trueness or less-than-smooth bearing surfaces is that the crankshaft will not turn easily and with uniform resistance when you have all bearings and pistons assembled. Operating an engine in this condition will ruin it -- severe scoring of your new bearings will result!

Oil Pump -- This is the heart; pumping needed lubricant and cooling to exhaust valve tappets, the governor gears and to the engine's main and rod bearings. When overhauling a 60-year-old engine, renewal of this vital organ is essential! So right after you remove the crankshaft for inspection of journals and main bearings, remove the pump for cleaning, inspection and a new set of gaskets. TIP: When reinstalling the oil pump, hand-tighten the mounting fasteners, install connecting lines inside crankcase - again hand-tighten. Then draw mounting bolts up tight; and follow by tightening line connectors.

Oil Filter Body -- The most opportune time for a thorough cleaning of the oil filter body and its associated parts is while the oil pump is removed. Low oil pressure or none at all can be a direct result of too much wrench torque on the oil filter cover nut resulting in a distorted oil filter body. Unfortunately some people have the mistaken impression that every leak can be overcome by more torque. The right solution is simple renewal of the A519R rubber gasket with each filter change. Many folks err here because this gasket doesn't come with the replacement oil filter cartridge. So, if you can observe any sign of distortion in the shape of the oil filter body (caused by over-torque stress applied to filter bolt to stop leaks), the filter body must be renewed. See Appendix 14 for expanded discussion and analysis.

TOOL FOR REMOVING OIL FILTER OUTLET FROM MODELS "A", "B", "D", "G" AND "H" JOHN DEERE TRACTORS

Occasionally it is necessary to remove the oil filter outlet from Models "A", "B", "D", "G" and "H" tractors. To do this job quickly and easily, we have designed a simple, inexpensive tool which any serviceman can make. This tool should be made from a piece of 3/16" round cold rolled steel 36" long, bent into a U, 1-1/8" wide (inside measurement), with ends of equal length. Two jaws are formed by bending 5/16" of the ends in toward the center of the U.



If a 3/16" rod is not available, a tool can be made from another size rod. However, when this is done it will be necessary to file the jaws to obtain a 3/16" diameter.

To remove the oil filter outlet, first remove the oil filter element. Next insert the puller in the filter can alongside the oil filter outlet tube, slip the jaws of the puller into the two holes in the outlet tube, then strike the bottom of the tool in a downward motion with some object to loosen the oil filter outlet. The connecting rod wrench that comes with the tractor is a good instrument for this purpose.

An Excerpt from Field Service Bulletin 128-S, 12/15/1941

Clean Lines! Ensure that the filter discharge line and connections are clean. One of these ports is AFTER the filter, and any contamination in this area will go directly to the distribution center of the pump that supplies oil to the bearings at start-up.

Oil Filter (Part Numbers) -- The Deere part number listed in the parts catalog for the filter element, AH812R, is no longer valid. It has been superceded by **AH 1082R**. Further, part number AH1111T is invalid as well. Deere & Company has tested and recommends use of genuine JD replacements. However, armed with a valid JD part number, and in the advent you can not get a JD filter, here is a short list of replacements that can be found everywhere. Equivalent oil filter elements include Baldwin # PT62, Co-op # PL6, Donaldson # P550192, Fleetguard # LF674, FRAM # C138 PL, Hastings # LF312, NAPA # 1148, and Purolator # PM352A. Don't forget to renew the **A519R** filter cover gasket.

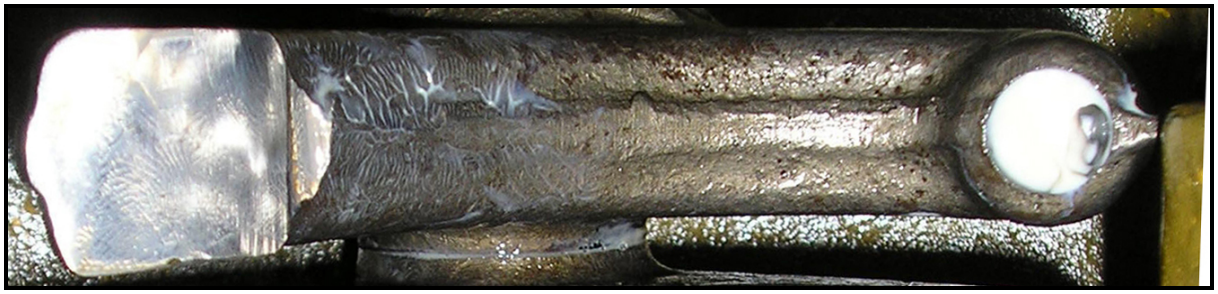


Figure 306. Smooth-Surface Cam Follower with Clean, Smooth Socket

Push Rods -- Push rods bend easily if the valve timing was off or if a valve was adjusted to be open all the time. You may have a tractor that was someone's mechanical learning experience. Visibly bent push rods should be tossed and others should be checked. Checking them can be done with a very flat surface, like the kitchen table, and feeler gauges. It is unwise to attempt straightening push rods. Instead, replace them with resources from a tractor salvage yard.

Tappet Levers -- Diligence during initial disassembly is critical. Note the pattern of exhaust valves on the outside with intake valves toward the center. Secondly, know that the tappet levers (rocker arms) for the right and left exhaust valves are not interchangeable nor are the levers for intake and exhaust interchangeable. This means that except for interchanging the two intake levers, they must all go back where they were before.

Tappet levers can be worn or even bent out of shape; either of which can make adjustment difficult. The first thing to examine is the wear patterns between the lever and valve stem. Some machining may be done to present a more square interface with the valve during reassembly. Push rod cups (in cam followers) should be smooth and round, and wear should be even; otherwise replace the follower.

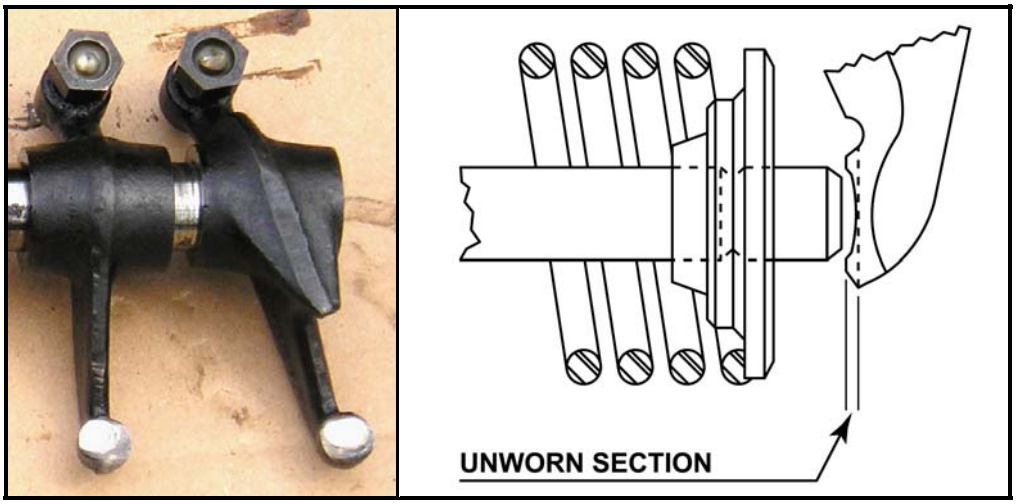


Figure 307 (A&B). Tappets - Left, observe excessive "cupping" wear. Right, solution is to grind away the "unworn" portion to provide a square or even a “convex” interface with the valve stem (Ref - FSB 146-S, Jul-Aug 1943).

Camshaft -- Camshafts can bend but it is unlikely since the push rods tend to sacrifice themselves much sooner. Problems for the "H" camshaft tend to be more pervasive than with other old tractors. The clutch drive disk can be a major problem if it ever became loose during operations. For the 1939 models, a straight spline interface was used. Later models used a tapered spline interface. The joint is ensured by proper torque applied in mounting the disk. This design provided for more trouble-free performance.

The normal problems with camshaft in this tractor will be worn and/or pitted cam lobes. For proper restoration, if you have a defective camshaft, I recommend that you purchase a reground shaft. This is normally done on an exchange basis. The cam lobe system is the heart of basic engine timing. Countless starting and running problems can result from "slacking" here.

39-H Camshaft Replacement – A later Series "H" camshaft may successfully be installed into the 1939 tractor, H-1000 – 9999. However, some other parts will also need to be replaced as well. The short list includes the belt pulley assembly and clutch driving disk. Another, but questionable replacement, may include the reduction gear cover. Some machining is needed for the H247R cover (camshaft, left end), enlarging the cavity to make room for the larger nut that comes with camshafts designed for 1940-up Series "H" tractors.

Cooling System

Do not be fooled into thinking of this as an easy one. More often than not, some shortcoming is likely to surface; perhaps as little as a defective radiator cap gasket, or as serious as a leaking radiator core, or one clogged up with "debris of the years".

Most of the water jacket on the "H" is cast iron, and this means lots of opportunity for rust. Rust particles can choke up a radiator core in a heartbeat. Another enemy is that limestone buildup is very common in many parts of this country. For older tractors, farmers frequently used water only, planning to drain water from the tractor on nights when they considered hard freeze a possibility. But the step of draining the tractor was easily overlooked, and some of them DID freeze and break! Years ago, farmers were torn between alcohol that tended to boil off as the engine reached operating temperature and a wide-spread fear of using permanent antifreeze; i.e., fear of engine seizure! Accordingly, look for broken and/or cracked radiator tanks and pipes, and for cracks and/or welds in the cylinder head and/or in the block.

The upper water pipe is prone to be close to the end of its life because of rusting through, and it is the lower pipe that is to be suspect for having been cracked by a freeze. So there is ample room for problems in the interconnecting pipes, hoses, clamps, overflow systems, and perhaps no shutter. Don't overlook the fan. HINT: For H-26999 and earlier, a section of standard 2-inch schedule 40 water pipe can be used to replace the lower pipe -- available at many hardware and builder's supply stores.

Radiator disassembly, cleaning and repair --- For most John Deere two-cylinder tractors including the "H", the radiator amounts to four pieces of cast iron and a copper core bolted together. The top and bottom tanks, held in strict relation to each other by two side castings, envelop the core. Many small fasteners bind a "sandwich" of iron pieces and plates of the core, top and bottom. This is the interface. If in a *Spruce up*, one may be spared the task of disassembly, provided the radiator isn't leaking and the tractor isn't overheating. For full *Restoration*, however -- or for a tractor that has not been running for a very long time, full disassembly recommended. This means removing many small, perhaps rusted-in 3/8-16 and 5/16-18 inch studs and/or cap screws from the tank castings. Prepare the radiator well in advance. Apply several liberal doses of penetrating compound (PB Blaster™ or Kroil ™) to nuts, bolts, studs and cap screws. Allow a day or "days" for soaking before attempting removal. Techniques vary as to how to back these stubborn fasteners out of cast iron. Application of heat is too risky. It may damage the core.

A firm grip between fastener and wrench is foremost. Now - think "impact" -- but not with overwhelming force! Some sort of shock works best. A small hammer (on the wrench) used with patience -- "tap-tap" one way, then "tap-tap" the other. Watch for movement. Then try working it back and forth. Applying a slow, steady force increases likelihood of a twist-off!

Separate the pieces, applying utmost care to protect the core from any stress or shock whatsoever! Most likely, one or more of the fasteners will twist off. One must then use wisdom, and conventional methods of removal. Complete the removals and make other repairs as necessary such as welding a crack. Clean and prepare the various castings (sandblast and prime if called for), straps and fasteners for painting. Sandblasting can be an effective means for dealing with rust inside the tanks once separated from the core. Following prime painting and before finish painting, use appropriate sized bottom taps to chase all threaded holes in castings. Insert dummy bolts into threaded holes prior to finish paint. Unserviceable threaded tapped holes in the tank castings should be over-bored and fitted with suitable Helicoils™ or Keenserts.™ Also - JB Weld ™ can come in handy to back-fill huge voids in the tank casting's gasket regions. Clean all debris from the core with shop air. Straighten the copper fins of the core. Body filler applicators come in handy for this. Once all cleaning and preparation is finished, the core is generally left in its oxidized copper color, and the iron pieces all painted John Deere Classic Green. Allow sufficient time for the paint to cure before final assembly.

Caution: If you carry the radiator core to a service shop for checkout or for repair work, be sure it gets a nice cushioned ride. The metal is some 6 decades old, is hardened and very fragile. Vibration is NOT your radiator core's friend!

Cosmetic Issues – Radiator Core and Fan Blades -- Radiator cores were not painted by Deere (except for overspray of green during factory painting). But if you must paint the core, choose black. It is generally agreed that fan blades were green, then hand-painted yellow (or white) on the back side for safety reasons until the mid 1940's. After that, fan blades were left green. However, fans for service parts were painted yellow! Other cosmetic issues relating to the cooling system are: (a) do NOT paint the hose sections, and (b) wire-type hose clamps were original configuration, and painted green.

Radiator Final Assembly -- Establish a clean work area for final assembly of the radiator. Usually, these decades-old castings no longer have smooth interface surfaces. Two thoughts come to mind. One is to take you tank halves to an auto engine rebuilder for some "flattening" just like one would for an engine head, and the other is to apply a non-hardening gasket sealer to both sides of each gasket. Permatex® Aviation Form-A-Gasket® Sealant has proven successful and the residue (squeezed out part) cleans up easily with mineral sprits. Or, you may choose **Loctite™ Hi Tack** type. Another solution is adhesive-backed cork gasketing between core and tank sections; found at an auto parts store or a radiator shop.

Radiator Bolt Set (Renew) -- All of the bolts and studs should be renewed. Clean and inspect 5/8 x 1-1/2 inch mounting cap screws; renew as needed. Apply anti-seize to all threads. Do not apply massive torque to the 5/16" fasteners. Draw them up as equally as possible. Observe that there are many fasteners decreasing a need for lots of torque. The 3/8 pieces may be drawn up quite tight; they along with the sides form the frame for the entire assembly. Once assembled, a final go-around on all fasteners is wise, but not drawn so tight as to warp the bolt straps. New bolts sets are available from www.jdhpubs.com

Cooling System Sealing -- Once the whole cooling system is reinstalled on the tractor and considered serviceable, the entire system should be sealed. Install a dummy plug in the upper water pipe where the temperature gauge normally goes. K&W Block Seal is one brand of sealer that is popular and effective. Always seal before adding permanent antifreeze. Regardless of your choice of brand, it's important to follow manufacturer's instructions.

The Governor

General -- The JD "H" governor is a multi-function assembly. Its primary function is to control engine speed over a wide range of varying load conditions. For best governor action, there should be no significant play in the fly-weight mounting brackets nor in the weight pins. Bearings are to be examined in accord with criterion set forth earlier in this chapter. Look for excessive wear of the lever driving the throttle control shaft. Finally, quality performance depends on the linkage adjustment between the governor and carburetor throttle. Secondary functions are to drive the cooling fan (plus the generator if tractor is so equipped), and the magneto via a coupling at the end of the governor shaft. Inspect the magneto flange and renew as needed. As always, a thorough cleaning makes inspection more effective. The governor-fan shaft interface is a complex and challenging area to restorers of JD tractors.

Governor Dynamic Testing -- With one hand on the throttle lever at the carburetor, note that engine speed can be controlled. Then, as speed is increased with the left hand, have a "sensing" feel (right hand) on the governor arm to see if it exerts a counter-force as speed is increased – this in an attempt control the speed. If the governor arm is lifeless, then you can be sure you have identified a defective governor!

WARNING -- The left-hand (L.H.) governor bearing housing should NEVER be removed and then reinstalled without first removing the magneto from the tractor. When the L.H. governor bearing housing is loosened from the governor, the governor bearing spring forces the governor drive flange away from the impulse coupling of the magneto. When this separation occurs, the impulse coupling on the magneto rotates to release any pressure built up by the impulse spring, changing the alignment of these parts. Most likely, the impulse coupling drive lugs are no longer in mesh with the drive slot of the governor drive flange. To install and tighten the L.H. governor bearing housing under this condition produces sufficient force to break the magneto mounting flange, body or impulse coupling (FSB 96-S, 4-15-39).

Disassembly and Overhaul -- Overhaul (mainly renewal of bearings) requires more than an average over-the-counter gear puller. After six decades together, these parts are likely to resist being separated. Disassembly of the governor was also challenging to JD technicians; so much so as to warrant issue of Field Service Bulletins describing special tooling and detailing its use. For removing and installing fan drive and governor gears, FSB 84-S (4-15-38) was issued for A, B and G tractors. This FSB was cited in FSB 121-S (5-15-41) for use with the "H" with an additional instruction to remove a particular snap ring not found on the other tractors. In view of this guidance from Deere & Co. to its repairmen, it is concluded that governor overhaul is a job best farmed out to a machinist having pulling and pressing equipment on hand for this mission. It is always my recommendation to prepare a Statement of Work (SOW) whenever you seek the specialized services of a service provider. This SOW should document in detail what you want done and specify the parts that accompany the SOW. This written document fosters understanding and agreement. Ambiguities will be ironed out as you consult with your machinist. **WARNING**: In the SOW, spell out the significance of the three woodruff keys and the three snap rings because the resultant position of key parts like the magneto drive flange depends on their use. The magneto drive flange must end up in a precise position. This is to preclude magneto drive issues during final assembly. Attach a copy of applicable pages of PC304 Parts Catalog, and your service manual or service guide. Include hand sketches if you feel they would help.

Low-Cost Governor Gasket Set (Reference AH1163R in Appendix 4) – The make up of this set assumes that the owner be very careful when removing old gaskets and shims. You must avoid damage to existing metal shims because if not mutilated, they usually are reusable. This substitute listing will save you at least $100 when compared with buying **AH1163R** Governor Overhaul Gasket Set from Deere.

A5272R - Gasket, Gov to Magneto
F1072R - Packing, Ventilator Pipe (2 ea)
H387R - Gasket, Gov to Main Case
H398R - Gasket, Gov L.H. Brg Hsg (3 ea)
H399R - Gasket, Gov L.H. Brg Hsg
H413R - Gasket, Gov Fan Shaft Brg Hsg (2 ea)
H414R - Gasket, Gov Fan Shaft Brg Hsg (3 ea)

Governor Bearings -- See figure 308. The original bearings for the JD-H governor were by New Departure, a source now dried up! The bearing comes in three parts (JD7151, 7152 and 7153), but is now supplied by Deere under part number JD7150. The main warning for you is that the current Deere part JD7150 IS NOT configured the same as the original parts, and they aren't low-cost either! In the JD7150 Deere replacement bearing, its roller balls are retained by a flimsy, soft jelly-rubber gismo. If alignment isn't just right when mating the parts, you may be down on your hands and knees searching for balls! Unlucky restorers have had miss-alignments where the balls fell away, but they DID NOT KNOW, and lost their fan drive and pinion gears as the tractor was started! 'Both frustrating and costly.

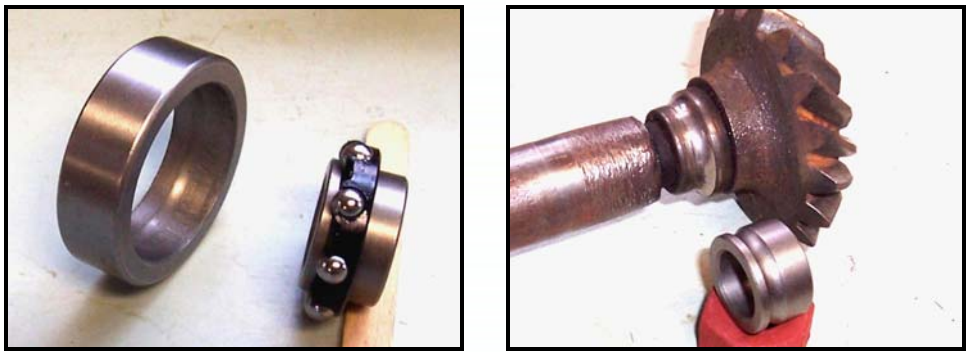


Figure 308 (A&B). On the left, is the Deere JD7150 bearing. Note the black bearing ball retainer -- it made of very soft, jelly-like rubber, and once installed may indeed cease to exist -- the bearing balls being held captive by the other two parts. In the right side photograph, you see one part of each bearing compared, original bearing on the shaft.

Governor Bearing Relief (NEW! In Figure 308C) – No longer do you have to pay enormous fees for an under-rated replacement! New tapered roller bearings by **www.jdhpubs.com** is now available at a fraction of this cost. And, it comes in <u>two parts, not three</u>. This is extremely significant because now there is no "floating part" to fall out of position during assembly. The bearing inner cone with rollers (one piece) press-fits onto the shaft, and the bearing cup (as before) presses into the bearing housing. See Green and Two Cylinder Magazines, and if you have Internet, go to GOOGLE and enter "**JD7150**".

Figure 308C. The New Governor Bearing, Sub for JD7150

Governor Lubrication – One of the oil pump's manifold outputs is to the governor. Oil rises inside the governor case to a point defined by presence of the 1/8" NPT plug, rear side of governor casting. From that point, the oiling channel is horizontal to the fan pinion and drive gears. Ensure this horizontal path is open. DO NOT ENLARGE PATHWAY. See figures 309 (A&B), Governor Oiling Channel.

John Deere "H" L.H. Bearing Housings

Left Hand Bearing Housings -- (See Warning above). While the governor remained the same over the years of JD "H" production, not so the L.H. governor bearing housing castings. The L.H. governor bearing was housed by four physically different castings with three different part numbers. The driving issues were: (1) power lift unit and (2) a need for increased oiling of the left camshaft bearing through H-17580. The oiling problem resulted in issuance of field changeover assemblies or kits.

1. Power Lift -- For early tractors, governor shafts were similar to their A, B and G counterparts -- the left end terminating with a ball bearing assembly with a rather flat bearing housing or cover. Beginning at H-27000, a longer governor shaft with a splined extension became the standard. The shaft extension was needed to drive a hydraulic power lift control unit that would bolt onto the governor casting in place of the H396R left bearing housing. As such, its function had to include housing the L.H. governor bearing. Casting H396R was changed -- driven by the longer shaft. Thus, for tractors not equipped with a power lift, the changed bearing housing (called the "pointy" one) provided sufficient room for the extended shaft. The part was changed, but not the part number. The reason is that the later version of H396R is fully serviceable on earlier units! Power lift unit installation on tractors before H27000 required the new, longer shaft be installed in the governor unit.

Thus, working a tractor with power lift makes the governor-fan shaft assembly more difficult to manage! The odds are that the tractor was operated for years without using the power lift -- also ignoring its lubrication needs. These power lift units are often found to be worn-out rust buckets. As a result, many owners decide to remove it from the tractor entirely. When you do, two choices exist: (a) find an AH1223R (with later version H396R casting) L.H. governor bearing housing with elongation designed to envelop the longer governor shaft (the "pointy one"), or (b) find and earlier vintage governor bearing housing such as an early AH1223R, or AH1222R (H802R casting) and shorten the long shaft! In so doing, be mindful that a neat feature is given up: the JD "H" power lift is a "live" lift. So long as the engine is running, the unit is operable. When the lift unit is removed, you should install **H898R (Safety) Extension**, PC304, page 29-16. On tractors H28840 and earlier, one will need to match-drill two holes, 11/32 inch in diameter, into the AH608R platform to facilitate mounting H898R.

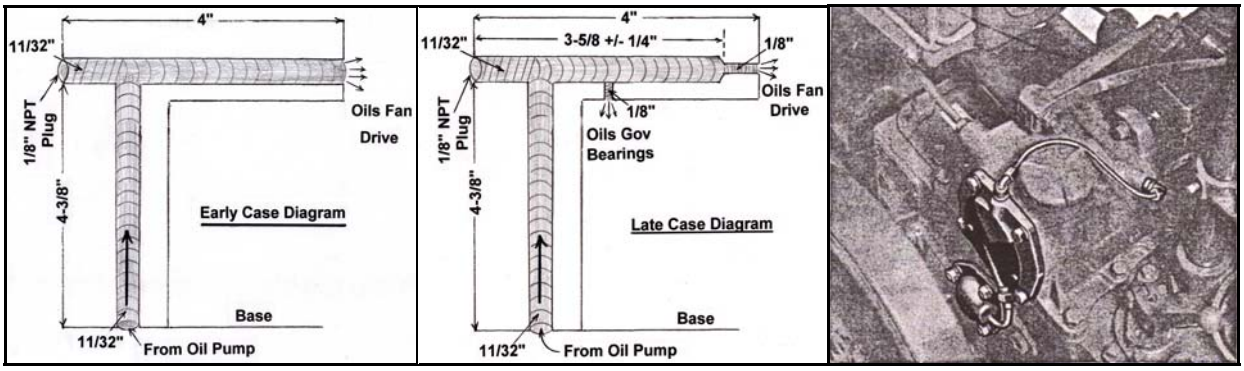


Figure 309 (A, B & C). Governor Oiling Channels, and Changeover Assembly

2. Field Changeover Assemblies -- External oiling kits were announced in FSB 121-S, 15-May-1941 (Late point of 1941 production), for tractors produced 14 to 33 months beforehand, and 14 months AFTER an apparent fix! That fix turned out to be a casting change in the H386R governor case, and kit analysis points H16626 as the change point. PC304 Model "H" Parts Catalog, page 5 defines the parts in each kit.

It is interesting is that there was no pipe from the rear side of the governor case (oil in-feed) from 16626-up! This tends to indicate that beginning at H16626, there is oil enough being delivered to the L.H.

governor bearing to warrant elimination of the oil in-feed pipe. While it's not written, one may logically conclude any number of reasons existed for keeping the oil pipe between L.H. bearing housings for the governor and camshaft. It can be surmised that momentum of the change, or even fear played a role in deciding to use the lower part of the oiling kit beyond H16626; dropped at H17581. Perhaps a flaw in the maintenance data drove product support engineers to this decision. At this point, we don't know.

Conclusion and Tests -- If your tractor has an **Early Case** governor (governor cases CAN be switched over time), the external oiling kit should be installed to protect the life of the L.H. governor and camshaft bearings. Lube by "Oil-Splash" is not sufficient. See Figure 309 above. The tests are as follows:

Early Case (Factory H1000-16625) -- The hole at the forward end of the horizontal pathway is full-sized *and* there is no outlet hole near the turning point of the internal oiling channel. You have to look inside of the governor case to learn this. Alternate Test - Remove 1/8" NPT plug, rear side of governor, and a section of **3/16" rod** can be inserted to a depth of **4-1/4 +/- 1/8 inches**!

Late Case (Factory H16626-up) -- The final 'fraction of an inch' of the forward end of the horizontal pathway is 1/8" in diameter *and* there IS a 1/8" diameter hole near the turning point of the internal oiling channel; again, as viewed from inside the case. Alternate Test - Remove the 1/8" NPT plug, rear side of governor, and a section of **3/16" rod** can be inserted to a depth of **3-5/8 +/- 1/4 inches**. (The length of the 1/8" diameter section varies).

TIP: The most vulnerable bearing for "Early Case" tractors is the L.H. Gov Brg. You can install a grease fitting into the L.H. Gov Brg Hsg for the adding needed lube. For Hydraulic-Lift tractors, at least install the top oil pipe (rear of case to upper L.H. Gov Brg Hsg). Or - consider a "Late Case" Governor Housing!

Governor and Fan Shaft Gear Interface

There are a number of applications where a combination of shims and gaskets serve as an adjustment between two operating gears. Surely this is true of gaskets and shims at two points: (1) where the fan shaft interfaces with the governor, and (2) the L.H. governor bearing housing (can be a hydraulic lift unit). These motley groupings of shims and old gaskets are, in essence, the adjustment spacers for heeling of the fan drive gear and bevel pinion, and for backlash! **Heeling** is to position the gear and pinion (See Figure 310) so that heels are in line. **Backlash** is the spacing or play between gear teeth.

Spiral-Bevel Gears -- The most challenging issue with the governor deals with its relationship with the cooling fan via the fan shaft assembly. Driving the fan is the heaviest load placed on the governor's drive gear and bearings. This load is increased for tractors with generator-electrical systems. Spatial restrictions drove engineers to use spiral-bevel gears to perform the governor and fan shaft interface; true for most all two-cylinder tractors. Spiral-bevel gears offer more teeth in contact than straight bevel gears. Size for size, they can carry more load and are quieter than straight bevels, but are much more sensitive to misalignment. Their shafts **MUST** be at right angles to each other, and in the same plane!

Replication of Gear Relationships – If at all possible, determining the pre-existing **heel** and **backlash** data would be helpful during build-up; to serve as a starting point. The significance here is these two gears are reinstalled in pretty much the same relationship as they have had for the prior 60+ years. To end up meshing them too closely at the worn state they are in would set them up for a new wear pattern and could hasten their demise. This discussion assumes the existing gears will be reused. **Journal it!**

The Overall Approach – If the governor and fan shaft have yet to be removed, collect data; record in your **journal**. Remove the magneto, and while holding the magneto drive flange still, measure and

record observe amount of free movement at fan blade tip. Carefully remove the shim and gasket “sets”, perform micro-measurement of thickness and record (two places) (1) The governor-to-fan shaft interface, and (2) The L.H. Governor Bearing housing-to-governor case interface. This data will be useful as a starting point during final integration of restored governor and fan shaft assemblies. Bag and Tag the two shim and gasket sets.

If These Two Assemblies Are Already Separated without data having been collected, you’re only alternative is, following restoration activity, go directly to the off-tractor integration Process Plan below.

Backlash versus Wear: Gear wear and backlash are not interchangeable. One cannot overcome the effects of tooth width loss of the pinion and drive gear by moving them closer together. Realize that wear narrows the tooth but does not necessarily shorten it. Thus, to move gear and pinion closer to reduce measured (or perceived) backlash, is effective only to a point. That point is defined as the condition where the tip of the gear tooth cannot clear the valley of the pinion -- the point beyond which gear teeth are cracked and even chipped away as a result of this interference. Examine pinion and gear teeth. If the flat top has worn to a point, you know the part is worn out! Even if it has some flatness across the breadth of the tooth, if that flatness has been reduced to half of its original value of 3/16 of an inch, be advised that getting continued use from these valuable little jewels will depend on setting "backlash" close to where it was; optimum 3/4 inch minimum, or to a point never less than 1/2 inch as measured at the fan blade tip. As much as 1-1/8 inch may be appropriate -- often determined during run up.

Single Unit Concept -- The service guide and all available reference materials instruct repair personnel to treat the governor and fan assembly as a unit when: (1) removing it from the tractor, (2) making HEEL and MESH (or backlash) adjustments which are done off-tractor, and (3) during reinstallation. By this point you are thinking, "No way am I removing and reinstalling both governor and fan shaft as a single unit!" You should, but many will not.

Backlash Observation

Methods -- There are two methods of expressing backlash between the fan drive gear and its pinion. One is for the laboratory and is an engineering standard which calls for a micro-measurement. A dial indicator is used to measure actual free space between gear teeth. The result is expressed as a number in the range of from 0.004 to 0.007 inches (FSB 113-S, 9-15-40) of backlash. The common method observes the amount of free travel at the fan blade tip (from one extreme to the other) while holding the governor magneto flange stationary, and the Bulletin translates the engineering criteria into inches of free travel.

Criteria, The Common Method -- To measure backlash as outlined in the service guide, the governor shaft must be held fast and the fan clutch must not slip. Remove the magneto to secure the flange. Observe backlash in terms of inches of free rotation at fan blade tip. Per FSB 113-S, you should observe from 1/4 to 3/8 inch of free travel. This is a "new gears - no wear" measurement. Should you expect a 60-year-old tractor to meet factory specifications? In general, the answer is "not really"! Up to three times this amount is reasonable for old gears. Your objective and budget will guide you here.

The Fan Shaft Assembly

Fan Shaft Service and Overhaul – At a minimum, the fan shaft subassembly should be disassembled, cleaned, and its bearings checked for continued worthiness. Pack the front bearing with high-melting point grease, renew oil seals and clean packing. Once the fan and governor unit has been removed and the two have been separated for overhaul work, remove the fan as a first step in disassembly of the fan

shaft. The fan may not have been removed for over 6 decades, and not every owner will have access to "a bar or press" as outlined in the service manual or service guide. If you have the tooling, it will work!

However, an alternative and widely accepted method of removing the fan blades is as follows: with the fan shaft in vertical position (fan up), jam fan shaft assembly down onto a wooden block, forcing the fan down into the front bearing. [No! The fan blades won't fall off!]. Remove the two split cone locks and the fan. Be careful not to stress the rubber bushing in the fan hub (standard for tractors without electric start up to H-50500). See PC304 Parts Catalog for order of parts during reassembly.

Governor and Fan Shaft -- Integration (Off Tractor)

A Process Plan -- Reference FSB 113-S, 9-15-40
Reference Figure 310

Integrate the governor and fan shaft on the bench using the renewed "sets", adjusting as needed to bring the fan drive gear and fan drive bevel pinion first into **heel**, and then setting **backlash**. If you have journaled data, you may use it here for a starting point. Once adjusted, either install "single unit" onto tractor or separate the units for storage, bagging and tagging your new "sets" to preserve vital adjustments of gear heel and backlash. You can use them during final assembly with the level of confidence you place in the on-bench adjustment operations.

1. Clean oil passageway, ensuring it is open.

2. Install gear assembly into governor case. Install L.H. governor bearing housing along with the pre-established gasket and shim set (if available), no gasket sealers at this time. Tighten cap screws.

WARNING!

If estimating thickness of the gasket and shim set, go thicker rather than thin. As you draw the cap screws tight, keep a close watch on gear mesh to ensure you do not draw these old gears into an interference fit that may result in damage to gears, to castings or to both. A wedge is a powerful tool!

3. Install fan shaft subassembly onto governor subassembly using the pre-established gasket and shim set (if available), no gasket sealers at this time. Tighten cap screws.

4. Check position of the governor arm fork. It should not bind. It should not rest on either top or bottom of the governor sleeve. It must be centered around the governor sleeve.

5. Position the governor-fan shaft assembly so that its open side is up and the operating parts are in plain view.

6. **HEEL** the fan drive gear and bevel pinion (line up the two gear heels), by adding to or deducting from the gaskets at the interface between the FAN SHAFT and GOVERNOR CASE. Secure the interface.

WARNING: This gasket thickness is NEVER to be decreased in an attempt to quiet the gears!

7. MESH the fan drive gear with bevel pinion to establish a "working clearance" between the two by adding to or deducting from the gaskets at the interface between the L.H. GOVERNOR BEARING HOUSING and GOVERNOR CASE.

8. NEW GEAR CRITERIA: Parts should turn freely by hand. The range of **backlash** is from 1/4 to 3/8 inches at the fan blade tip.

9. ORIGINAL (Worn) GEAR CRITERIA: Parts should turn freely by hand. The range of **backlash** is from 1/2 to 1-1/8 inches at the fan blade tip.

Figure 310. Governor and Fan Shaft Integration

Governor and Fan Shaft -- Final Assembly

A Process Plan -- Reference FSB's 87-S (7-15-38) and 113-S (9-15-40)

1. **Mount the governor and the fan shaft assemblies** timed to the engine. If separately mounted, install the fan assembly and secure to governor using pre-established thickness gasket and shim set. Ensure flywheel is correctly positioned on the crankshaft by observing that the two "V" marks are in register. Position the engine at TDC for the No. 1 cylinder (flywheel side). "L.H. IMPULSE" on flywheel aligns with mark on sliding shaft bearing cover (at 3:00 o'clock). Rotate governor shaft until the **slot** in the magneto coupling flange is parallel with the top of the crankcase, and lower assembly to mesh the gears, FSB's 87-S (7-15-38) and 113-S (9-15-40).

2. **During engine run-up testing**, listen carefully for gear noise. If gears are noisy, two causes are to be considered: (a) Misalignment of fan shaft front bearing support, and (b) incorrect gasket thickness between L.H. governor bearing cover and governor case.

CORRECTIVE ACTION # A: The correct position of the fan bearing may be determined by starting the tractor and moving the front fan bearing slightly to the most quiet position (FSB 87-S).

ADDED TIP # A1: Try moving the front fan bearing support (H417R) slightly (up or down, and to the right or left). As noise is reduced, seek the most quiet position. Secure front bearing support accordingly.

ADDED TIP # A2: Then loosen the three cap screws holding the rear fan bearing housing, and if more quiet operation results, add another gasket under rear fan bearing and tighten cap screws (FSB 87-S).

CORRECTIVE ACTION # B: One thin gasket can be added to or deducted from the L.H. Governor Bearing Cover to quiet gears.

WARNING: The L.H. Governor bearing cover should NEVER be removed and then put back on without first removing magneto from tractor.

The Clutch System
(Ref PC304, Page 10 - Fig. 311)

Operation -- The JD "H" clutch operates by pressure and friction. The pulley assembly (16) and adjusting disk (8) close onto the drive disk (9) to form the driven element. Engaging the clutch is the compression of these three parts. The adjusting disk is "along for the ride". The drive disk is hard-mounted to the camshaft, and the camshaft is driven by the crankshaft. The pulley assembly includes a gear that drives the reduction gear (PC304, page 25-19), and the reduction gear is the bridge from engine to transmission.

At the center of clutch engagement is the operating sleeve (71) with force being applied by a thrust collar (26). The thrust collar is driven by a fork (60) through the clutch fork shaft (56); this is a result of the clutch lever (48) rotating the clutch fork shaft via the clutch shaft lever (53) and associated linkage. Actual movement is a combination of bringing the adjusting disk toward the operating sleeve and pulley, putting the clutch drive disk into a "squeeze" within the combination of the adjusting disk, drive disk and pulley. Both the pulley and adjusting disk will move as the clutch is engaged, each drawing up onto the drive disk.

The amount of disk pressure is set by clutch adjustment -- the three bolts (24) with castellated nuts and cotter pins. A set of three clutch dog (21) and toggle (19) assemblies working together is what keeps the clutch engaged. As the clutch lever is moved forward, the toggle is swung past "dead center" and is designed to remain in that position until the clutch lever is pulled back. The amount of pressure required to engage and to disengage the clutch is determined by adjustment of the three clutch-adjustment bolts. If too tight, clutch lever travel will be insufficient to bring the clutch dogs over dead center, and if too loose, passing over dead center may not apply enough compression within the combination of the adjusting disk, drive disk and pulley.

Clutch Disassembly -- See PC304, page 10. Pay attention to the service guide. PRIOR to removal -- use a center punch to place a registry index mark on three items: the H353R fork (60), it's H354R (56) shaft, and on the H358R lever (53). This provides a guide during reinstallation, and is intended to avoid trial and error. During reinstallation, the nut holding the driving disk on the camshaft must **be tight**.

If your "H" tractor has a serial number below 10,000 ('39 models), pay close attention to differences such as a **snap ring (10)** that must be removed in order to get the belt pulley off.

TIP: Any time the belt pulley is removed for a maintenance or repair action, seize the opportunity to clean and repack the belt pulley roller bearing (H10,000-up).

Clutch Inspection Points -- Evaluate the driving disk (9). It was 0.500 inch thick when new. A minimum of 0.375 inch thickness (3/4 original) must remain for continued service. When new, approximate thickness values for each of the two fiber facings is 0.160 inch and for the substrate, 0.175 inch. Inspect the splined or fluted interface it has with the camshaft. For S/N 10,000 and up, you will need a puller for removal. The condition of the clutch drive disk and camshaft is super-critical. Looseness spells trouble! Inspect the facing of the AH1216 adjusting disk (8) for roughness and pitting. If rough and/or pitted, repair is by a machinist taking off some 0.020 to 0.040 inch to achieve flatness. Apply "field use gear standard" to the belt pulley gear and to the reduction gear (Reference Appendix 7, page 2).

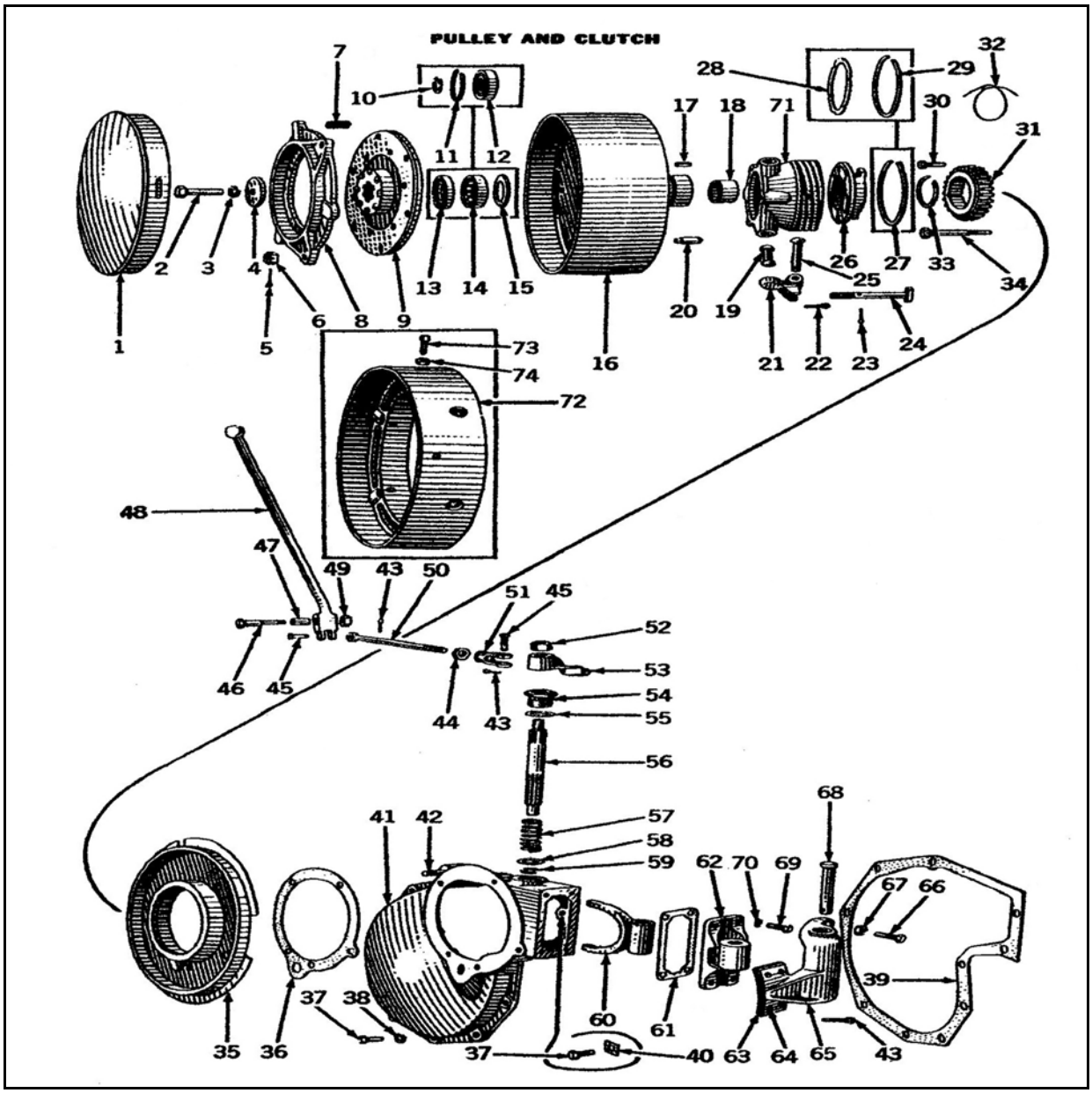


Fig. 311. Pulley & Clutch, John Deere Series H Tractors

Be especially attentive to the condition of the bearing (12 or 14) and pulley bushing (18) in relation to the camshaft. Arbitrary renewal of the pulley bushing (H334R) is a standing recommendation.

Working parts of the Series H clutch -- These are the B145R clutch dogs, B144R toggles ("dog bones"), and B146R dog pins -- those involved in the "snap" we all seek to hear and feel. If any of these parts are severely worn or worn so that they are deformed, the clutch will not operate satisfactorily. The clutch dogs should round, smooth sockets. The sockets of the operating sleeve should also be round and smooth. The toggles ("dog bones") are to have equally round and smooth ball-like ends for interface with the clutch dogs on one end and the operating sleeve on the other. When new, toggles measure 1-11/16-inches long and ball diameter is 5/8-inch. The dog pins shall be uniform in roundness and thickness throughout their length, and if worn such that a variance is felt of seen, renew the pins. Operating bolts are to be straight and free of distortion. It is very important to chase the threads on each H339R bolt and also the three B1363R castellated nuts. There shall be no resistance to rotation offered by these threads. Be

especially critical of the three small H343R springs, now on the job for over 6 decades should be arbitrarily renewed.

Operating Sleeve Drive Pin -- (See PC304, page 10) -- Observe that the operating sleeve (71) is free to move in and out on the belt pulley (16). Note also that the sleeve and pulley rotate as a unit. The joining unit is the clutch drive pin (20). Recall that the operating sleeve sockets form one end of the two sockets for the clutch toggles or "dog bones", thus the need for the sleeve and pulley to rotate as one unit. Inspect to ensure the pin remains tight and straight in the pulley (pressed-in), and that there is not more than a "reasonable" amount of play between the pin and sleeve, thus allowing rotational variance between sleeve and pulley. **Rotational variance should not exceed ¼-inch, measured at the sleeve socket for the toggle**.

Corrective action for a "too loose" condition requires machine shop tooling and expertise. The basic approach will be to remove drive gear, snap ring and operating sleeve, and then proceed (basically) to oversize the drive pin. Install new oversized pin into pulley; then overbore the sleeve to accommodate increased drive pin diameter.

Machining the Operating Sleeve -- A Last Resort Act -- To obtain efficient clutch action it is sometimes necessary to renew toggles, pins and clutch dogs. If renewing these parts and verifying soundness of the operating sleeve-pulley relationship do not restore original action to an excessively worn unit, machine approximately 0.030 off the outer end of the operating sleeve (24). This machining will permit the sleeve to move further to the right in the clutch-engaged position and provide a more satisfactory lock.

Clutch Linkage -- Removing Excess Play -- The variables here include the two 7/16 inch diameter yoke pins (45) and their respective yokes, the pivot bolt bushing (47) for the clutch lever, and the splined interface between H358R shaft lever and its shaft.

Most often, R/R of the B177R bushing (47) will remove most of the 'wobble' (left-right play) in the clutch lever. If the lever still has excessive 'wobble', weld or braze to reduce the diameter of the bushing interface bore. Then re-drill to fit the new B177R bushing.

Renewal of the two B178R yoke pins (45) is the next logical step to reduce travel. Carefully inspect the yoke pins; any discernable wear is too much! If, however, after renewing the yoke pins, the clutch lever still has excessive travel or play in the yoke pin area, two choices exist: (1) going to over-sized (1/2" diameter) yoke pins and boring the yoke pieces to fit, or (2) weld or braze to reduce diameter of the yoke pieces then re-drill to fit the new B178R yoke pins.

Reduction Gear Cover -- This cover (41) is like the top of a covered bridge. The bridge it covers is the reduction gear because the reduction gear is mounted onto the transmission sliding gear shaft and drives the transmission, but receives its drive from the gear on the belt pulley assembly. The gear forms the bridge between the engine and transmission. Besides being a cover, this item has some hefty tasks to perform which include keeping dirt out, and collecting and returning transmission oil from the slinger part of the clutch operating sleeve (71) with help from the dust shield (35). There are no pilot pins (locating pins) provided, and yet cover position plays a role in positioning the AH605R Dust Shield. When the dust shield is installed, it is vitally important to avoid interference with the operating sleeve part of the belt pulley. When installing the cover (41), use the outer edge of the boss on H346R casting (41) (which interfaces with AH605R dust shield) as a guide. Measure into the camshaft. When all measurements come out equal, this casting is centered. Tighten a couple of cap screws, then mount the dust shield, measuring from at least three equally spaced directions into the camshaft to ensure it is centered. To verify that it is properly centered, temporarily install the belt pulley to test for the absence of any rubbing or scraping. There shall be none! See Appendix 6 for Process Plan.

Figure 312 (A&B). H253R cover with oil tab (left). Observe two return paths behind the "tab well".

Clutch Pulley Oil Return – During final buildup of the clutch and reduction drive section of the tractor, attention to detail is required to prevent a second teardown. Ensure the upper transmission oiling (return) system is complete and free from clogging sludge. H253R cover with tab is bolted onto the right side of the case. The purpose of this tab is to collect splash oil from the reduction gear and direct it into the case where two separate channels carry the oil to lubricate the left and right bearings of the sliding shaft. The upper part of the transmission would otherwise be running dry during stationary operation. Ensure the tab is there and squarely over the reduction gear, and that both oil return paths are open. See Figure 312 (A&B). See transmission lubrication system in chapter 4.

Engine and Clutch Reassembly -- See detailed reassembly instructions for the engine and clutch in **Appendix 5** (crankshaft, main bearings, camshaft and basic engine timing) and **Appendix 6** (cylinder block and pistons, engine head, clutch and reduction gear cover).

Engine Run up - All Systems Check -- Once reworked, the engine along with the entire fuel system must be trial tested on the tractor prior to final paint. Strap the fuel tank into position atop the tractor using the rear tank bracket and a ratchet strap or belt, and run all of the regular fuel lines to their normal destinations. Tighten all fuel fittings without using excessive torque. They are easy to over-tighten, and so nasty to deal with if you do! See Engine Run-Up in Chapter 2. Also, see Governor and Fan Shaft Integration and Final Assembly Process Plan later in this chapter.

The list of things to be on the lookout for here is far too long to enumerate. Starting and running in general is first. Then be vigilant for leaks, special noises like bearings or gear anomalies, odors that spell trouble, carburetor, governor, and electrical systems performance to list a few. **Journal** all results, take remedial actions, and rerun until all areas of concern are successfully resolved.

Details Easily Overlooked -- For engine run up you must have water in the cooling system and oil in the crankcase. The temperature and oil pressure gauges will not be on the tractor at this time. Therefore, in all engine run up exercises, you must have a temporary hook up to a "floating" oil pressure gauge and plug the temperature gauge hole of the upper water pipe (1/2-inch NPT) to contain the engine coolant.

A Tale of Woe, A True Story -- The importance of complete engine run up before final paint and sheet metal installation cannot be over-emphasized! Recently I talked with a man who had just finished a John Deere Model 630. This tractor looked better than it did when it left the factory some five decades back. It was GORGEOUS! After he thought he had completed restoration, he discovered a leak between the engine head and manifold. Now he has to perform tear-down far enough to remove both the head and manifold and have the interface between the two machined! This is a clear case where through diligence, a pre-paint engine run up would have caught such a leak. This man runs a paint shop and wanted to feature this tractor to show off his paint products. He also planned to run the tractor in the local county

parade of tractors in the fall. But the display will have to wait as his Big Johnny goes back to the repair barn. "Has to hurt"!

Governor Adjustments

Speed Adjustment -- With no load, adjust the max throttle set screw on lower steering column to limit engine speed at 1540 RPM (Fast Idle). This equals 770 RPM at the pulley. The result of making this adjustment sets engine speed under a load at 1400 RPM, and 700 RPM at the pulley. Slow Idle for this engine is from 600 to 650 RPM. (Ref FSB 137-S, 9-15-42).

Alternative RPM measurement -- Jack up rear wheel on one side of tractor. Set brake, and also place chock blocks for and aft of the wheel not jacked. Place gear shift in REVERSE, and gently engage the clutch. Advance hand control throttle lever to full speed ahead (Fast idle). At 1540 Engine RPM, the jacked-up wheel should complete 30 revolutions per minute (Ref, FSB 121-S, 5-15-41).

The foot pedal throttle control should be set as close to 1800 RPM as you can measure. Using the alternate RPM measurement method, the foot-pedal set screw is to be adjusted so that at its full-down position, the jacked-up wheel should complete 35 revolutions per minute.

Linkage Adjustment -- Free up and align all linkage to remove any binding. Adjust or renew any parts causing lost motion, and disconnect throttle rod at carburetor.

With hand control in full speed position (engine not running), adjust the length of the carburetor throttle rod so that the rod is 1/2 hole short from entering hole in carburetor throttle shaft lever when carburetor butterfly is in wide open position. Reconnect throttle rod at carburetor.

Little Known Facts

Over Pulley -- A rare and not widely known "over-pulley" was designed to increase belt speed from 2245 to approximately 3000 feet per minute. The over-pulley diameter is 16 inches and attaches to the regular pulley using six (6) set screws with jam nuts. Careful scrutiny of the Parts Catalog will indicate two distinct over pulleys, one for early tractors, and a different one for those after S/N 16634. They are not interchangeable! The increased belt speed was needed to operate the John Deere No. 10A Hammer Mill. See PC304, page 41, Item # 71 (Reference, FSB 115-S, 11-15-40).

PTO (H607R) Guard -- You probably wonder why one would buy a tractor with a power shaft option and then put a "can" over it! If you have an early Model A or B tractor, the "can" made a fairly good step. If you come across one for the JD "H", try to buy it and watch the reaction.

Spark plug shields -- From FSB 100-S (8-15-1939) -- To protect spark plugs from plant stalks and foliage which would cause a short circuit, spark plug shields have been added to the Model "H."

The AH775R Spark Plug Shields are attached to the front end assembly by means of a 5/16" cap screw inserted in the tapped holes already provided. The spark plug shields were started in production on Serial No. **H-7919,** and then made available for all tractors in the field at no cost to owners.

The AH775R Spark Plug Shield Assembly included the left and right spark plug shields with two bolts and two lock washers for attaching to the front end assembly. Spark plugs cannot be removed or installed without removing shields; hence, all Model "H" tractors after Serial No. **H7919** had the spark plugs installed in the cylinder block rather than shipped in the tool bag as they were before.

Engine Timing for “H” Series Tractors

FLYWHEEL VERIFICATION

Be sure the flywheel is installed correctly. The “V” mark on the flywheel should register with the “V” mark on the crankshaft.

VALVE TIMING TEST

With valve tappets set to 0.015-inch gap, turn flywheel in normal direction of rotation until the exhaust valve if the left cylinder is just beginning to open (.000 tappet gap). At this time, the flywheel mark “L.H. EXHAUST OPEN” should be in register or within one-half inch of the index mark on gear case or sliding gear shaft cover (At 3:00 o'clock when viewed from left side).

RETIMING OF VALVES

Remove the governor case and remove camshaft left bearing housing (or cover on earlier models), and remove the left bearing. Remove belt pulley and clutch assembly, then remove reduction gear cover and loosen the camshaft right bearing housing. Lift end of camshaft up so that camshaft gear and crankshaft gear are out of mesh; the turn crankshaft until valve timing is as specified.

If the “V” marks on camshaft gear and on camshaft are in register, and then adjust the relationship between crankshaft and camshaft until the marks on camshaft gear and crankshaft gear are in register. However – if camshaft gear and camshaft “V” marks fail to be in register, you may elect to leave them as they are found – using the “valve timing test” above to achieve and verify a “correct” relationship between camshaft and crankshaft.

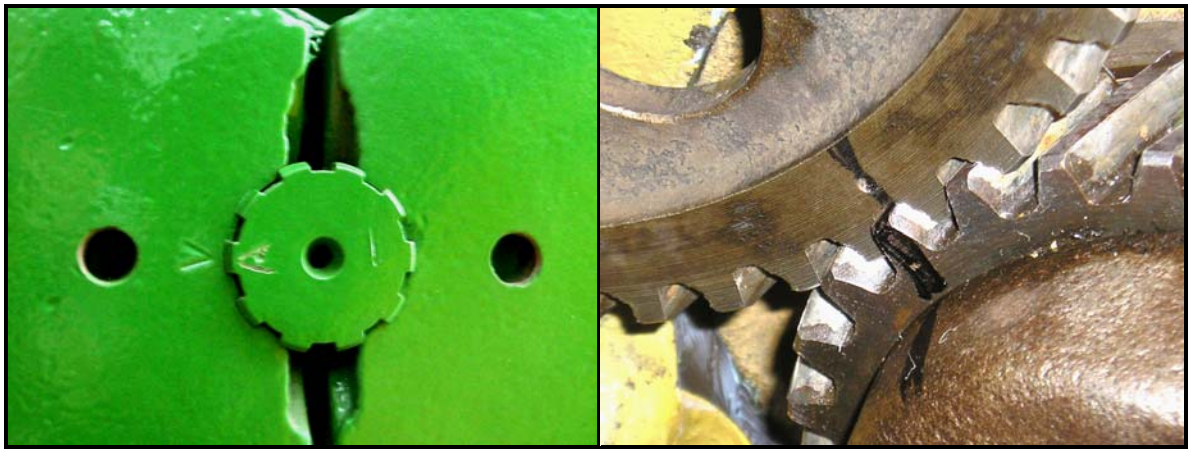
GOVERNOR SHAFT TIMING

When finished with valve timing, install governor. With either engine piston at TDC, the governor’s magneto drive flange groove shall be horizontal.

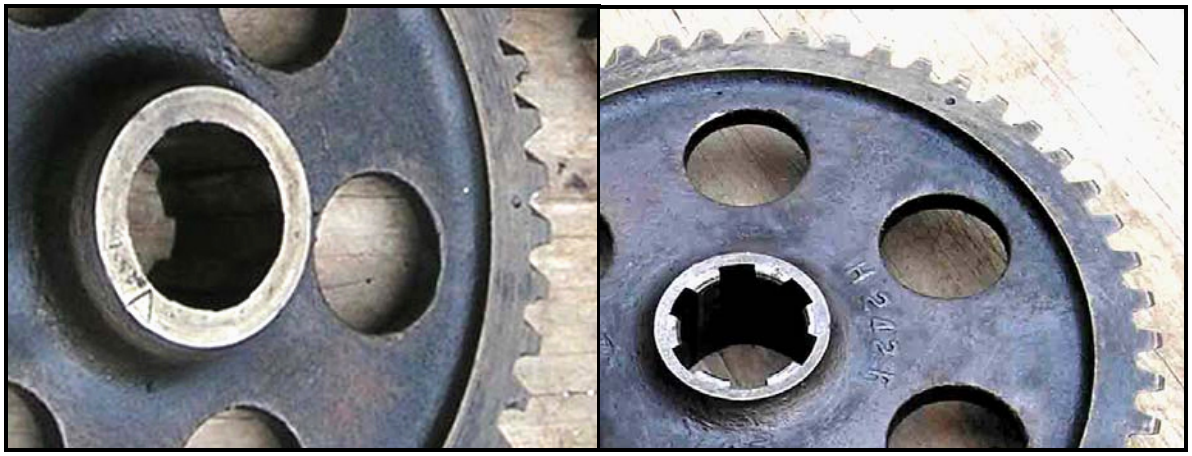
MAGNETO TIMING

With engine at "No. 1 Just fired TDC" and magneto at "No. 1 just fired (top wire)", install magneto with cap screws only finger-tight. Rotate magneto fully to the rear. Reverse rotate flywheel a half revolution, and then bring it back to "No. 1 just fired TDC". Carefully rotate magneto forward until the impulse snaps. Tighten in place. ++++

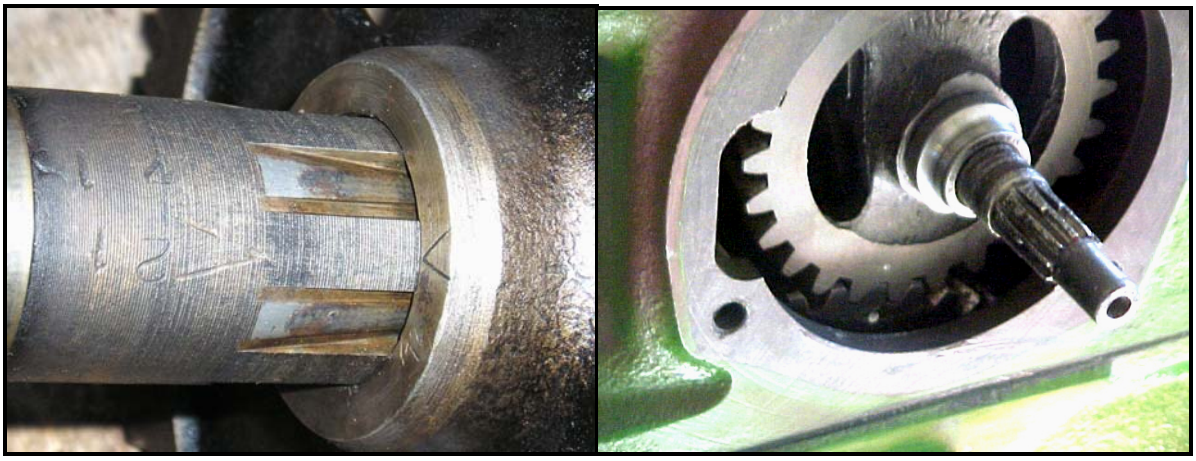
Figure 313 -- Basic Engine Timing (Picture form)



Flywheel-to-crankshaft registry (left, "> to <"), Cam-to-crank "dot-to-dot" (right)



Cam gear -- pulley side, see "V" & "dot" (left) and flywheel side, see "H242R" and "dot" (right)



Cam gear-to-camshaft registry (left, "> to <"), Governor gear-to-cam gear, "dot-to-dot"

NOTE: The magneto flange position criteria is that it be horizontal with either piston @ TDC.

Transmission, Final Drive, and PTO

Chapter 4

Introduction and Overview --- This area can be a major part of the restoration because it includes the tractor's brakes and power takeoff system as well as all of the gearing and shifting mechanisms that drive it. Normal day-to-day operation will usually have taken its toll on these elements. At minimum, be prepared to totally overhaul brake components, and usually the gear shifter (lever) assembly.

The first few pages of this chapter along with Figures 401 through 405 and page 28 of PC304 provide a thorough introduction and overview to the JD "H" tractor section generally called the Transmission, Final Drive, and PTO. Consider these few paragraphs the "Theory of Operation" for this tractor, meant to make the reader very familiar with the JD "H" working sections.

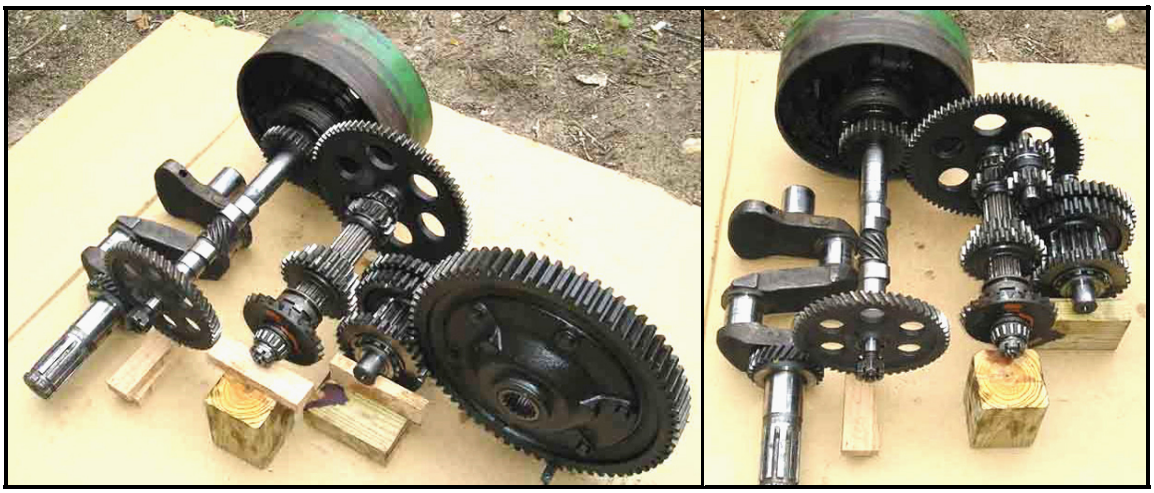


Figure 401(A&B). John Deere "H" Tractor Drive Train Mock-up.

Figure 401. These photographs put the JD "H" tractor transmission, final drive and PTO section into perspective. All drive from the crankshaft travels through the camshaft, through the clutch and belt pulley, to the reduction gear (2nd largest in diameter) to drive the transmission that delivers motion to the differential via the big gear. Rear axles insert into the big gear-contained differential assembly from each side. ***NOTE: Differential (Fig 401A) situated 180° from normal - should be reversed!***

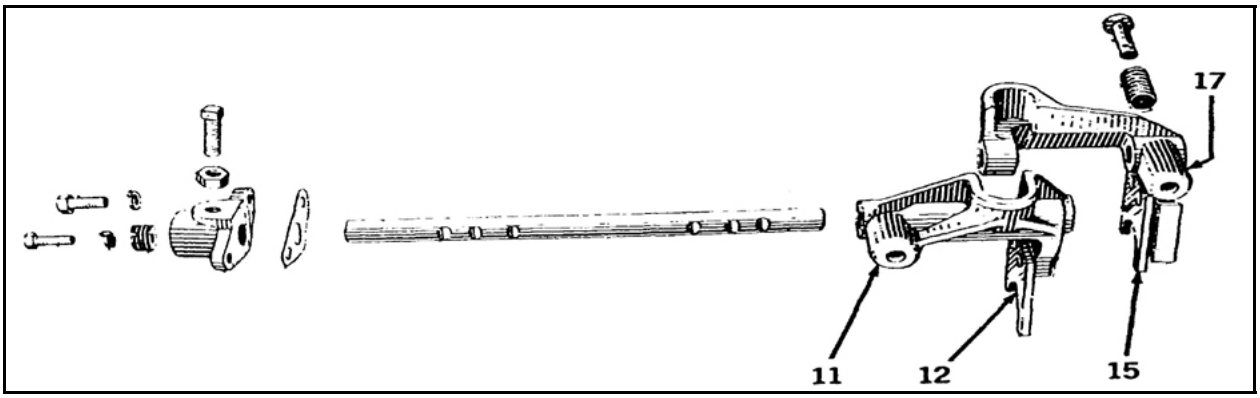


Figure 402. Shifter Shaft (10) and Shifters (11 or 17) -- Illustration Only

The bevel gear at the left end of the sliding shaft (figure 401) is the PTO drive gear, driven by moving a notched drive collar on the slider shaft, into the gear's notched interface by a PTO shifter. This gear,

collar, and its shifter are not shown in figure 403 (PTO was always an extra-cost option for the JD "H" tractor).

Shifters on the shifter shaft (fig 402) direct all shifting in the transmission. By a yoke interface (12 or 15), the shifters (11 or 17) move either of the two drive pinions along the sliding shaft (figure 403) to make connection between the clutch-driven sliding shaft through the counter shaft and into the differential assembly contained within the big gear.

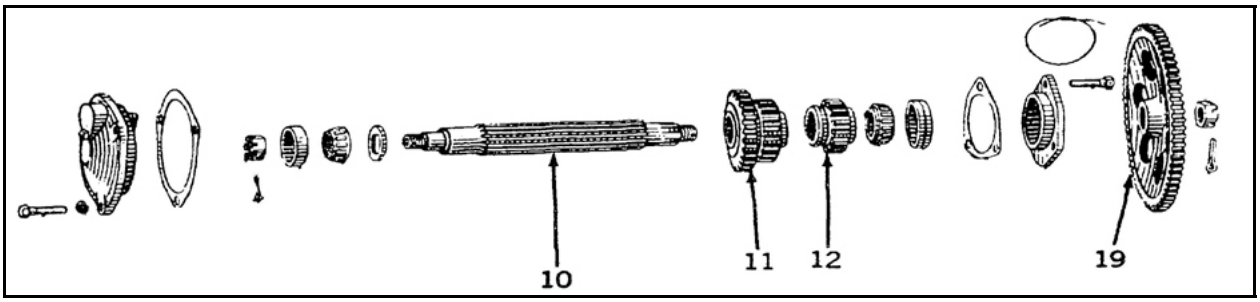


Figure 403. Sliding Gear Shaft Assembly -- Illustration Only

The sliding shaft (10), two drive pinions (11 and 12), and the reduction gear (19) are shown in figure 403. The shaft drives pinions 11 and 12. These pinions in turn drive gears on the countershaft (figure 404). The PTO drive gear is not shown. There is adjustment with shims on the sliding shaft to both preload the taper bearings on the sliding shaft and then, once done, adjust the shims to set backlash for the PTO bevel gears.

The interconnecting relationship between sliding shaft and big gear will be one of three forward gears on the counter-shaft, or may also bring reverse gear into play. The reverse gear shaft is set atop the sliding and counter shafts in the right-side photo of figure 401.

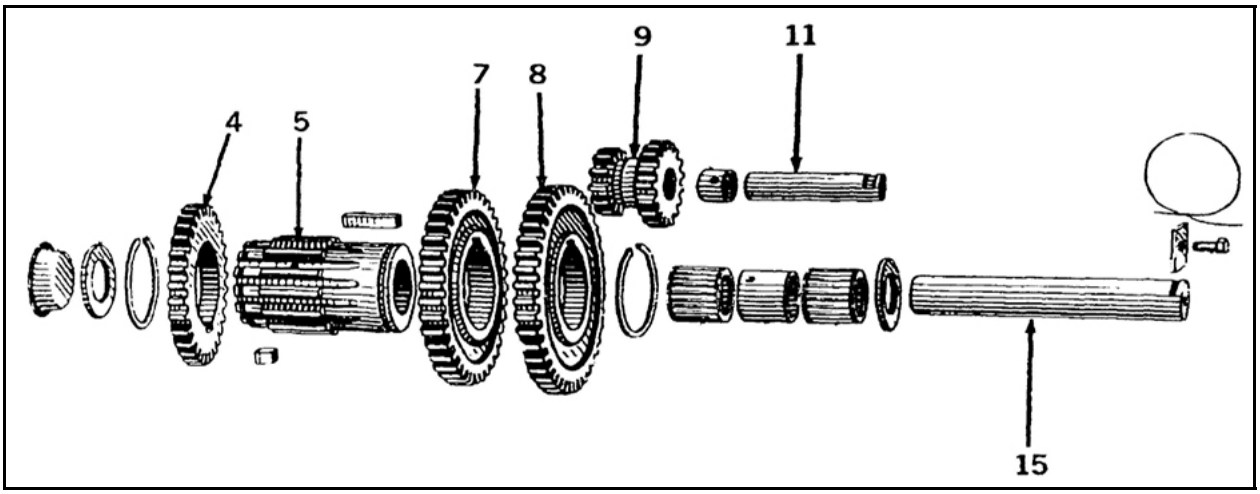


Figure 404. Countershaft and Reverse Gear Assembly -- Illustration Only

The three forward drive gears (4, 7 and 8) are lock-mounted (keyed) onto the drive pinion (5), and rotate as a unit on the counter shaft (15). It is the pinion that directly drives the big gear. Reverse gear (9) freely rotates on its shaft (11) to change direction of rotation drive applied to the pinion. There are no adjustments associated with either shaft during build-up. However, a preload is applied to the sliding shaft taper roller bearings by adding or deleting shims.

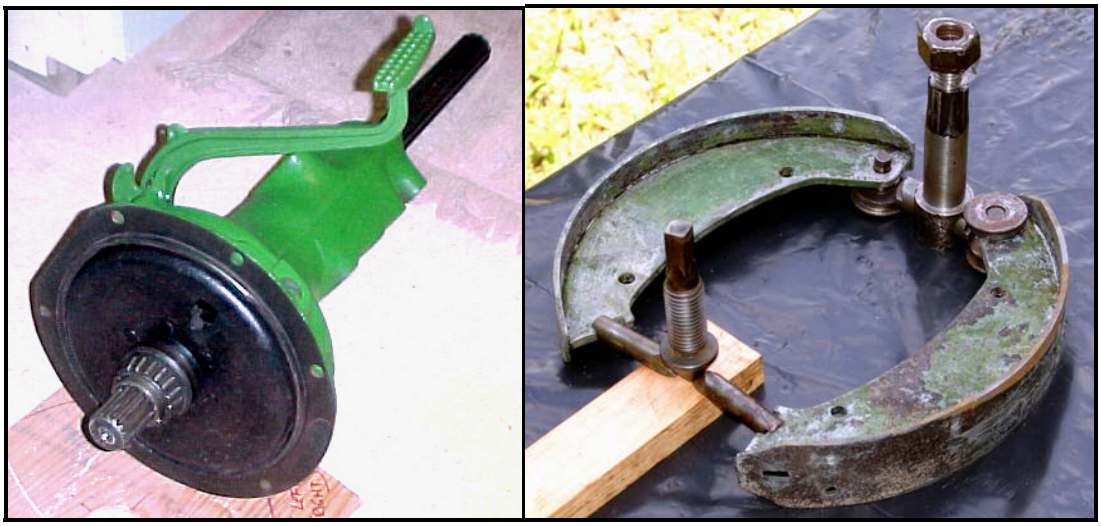


Figure 405(A&B). Rear Axle Assembly (A) and Brake Shoe Mock-up (B)

Brakes -- Figure 405A shows the finished left-side rear axle assembly ready for installation. See splines at the axle (lower left end). This end inserts into the differential assembly. Also shown at left is the brake drum. Inside the drum are two brake shoes as shown at right in figure 405B. The fixed pivot contains the brake adjust mechanism (lower left). To apply the brake, the brake pedal attached to the pedal shaft (upper right) rotates the pedal shaft. A cam at the end of the pedal shaft opens the gap between the shoes as the pedal is depressed. Expansion of the brake shoe pair inside the brake drum provides braking.

Notice the tapered roller bearing (Fig 405A). There is another very similar such bearing enclosed at the outer end of the axle housing. An important bearing load adjustment is performed after attaching each axle assembly to the main case. The left side axle and right side axle bearing load adjustments are performed independently of each other.

Power Shaft -- See PC304, page 28. For what may appear to be a simple, straight-forward design, JD "H" power shaft and its installation provides its share of challenges. At this stage, observe the sliding shaft (31), PTO drive gear (20), the power shaft and its drive gear (43 and 38), and several varied options of shielding. The "H" can have either a **1-1/8** inch diameter or a **1-3/8** inch diameter power shaft. The shaft diameter has a direct bearing on purchase of replacement parts for virtually all parts numbered 43 and up (PC304, page 28). This drawing also depicts the PTO shifter subassembly to include the drive collar (32), shifter with yoke (16), shifter crank (15) and shift lever (4).

Removal and reinstallation of the master shield (50) is tricky. If a flipper guard is also involved, the master shield is best removed and reinstalled along with the stand-up platform; that platform under the seat assembly. With the flipper guard, the shield should be attached to the platform **PRIOR** to installation of the mated pair onto the tractor. Without the flipper guard, there is no problem mounting the master shield separate from the platform.

Transmission Lubrication System -- Lubrication of the transmission and differential is entirely automatic. It starts and stops with the engine driving the tractor. The differential and final drive gears are partially submerged in transmission oil. When they revolve, oil is carried up to all transmission parts, completely bathing gears, shafts, and bearings.

These "partially submerged" gears do not include gears along the sliding gear shaft. The primary lubrication system for the sliding gear shaft bearings and gears is the catching of oil being cast off of the reduction gear. Oil is "caught" by a small tab attached to the H253R cover (Figure 312, Ch 3) that goes

over the end of the cam follower shaft. The tab deflects oil from the gear to a small well. Two paths for oil flow from this small well, one to the right sliding gear shaft bearing, and one to the left. When Model "H" tractors are operated in the field, we have "wave action" being produced which brings oil into a sump for pick up by the reduction gear. This sump is formed between the gear cover and main case. Two other bearing surfaces lubricated with oil cast by the reduction gear are the pulley side camshaft bearing and the belt pulley bushing.

Lube Deficiency, Stationary Operation - When the tractor is used to grind feed, cut wood and other belt jobs for long periods of time without being moved, there is no wave action and without wave action, oil is not "tossed" into the sump. Thus it is soon emptied, and no oil is carried to the upper transmission gears, shafts and camshaft or pulley bearings (gears on sliding gear shaft are not engaged with final drive gears). FSB 98-S, dated June 15, 1939, states that when the tractor is used for long periods of time (over 30 hours) without being moved, one gallon additional oil is required in the transmission to insure lubrication of the bearings and gears. While no instruction of this nature has been found in later literature, we observed that detailed measurements taken from H700R main case casting indicate that this bulletin applies equally to all H series tractors.

The belt pulley bearing and belt pulley bushing act as bearing and bushing only when the clutch is disengaged. They otherwise simply turn along with both the pulley and camshaft. The pulley bearing is pre-packed as part of an annual service routine while the bushing is lubricated with transmission oil splattered and cast by the reduction gear. Oil in and around this bushing is returned by the oil slinger function of the clutch operating sleeve, a return path toward the bottom of the clutch system dust cover on into the reduction gear cover, and then into the main case. Interesting observations on the camshaft: (1) the flywheel side bearing is lubricated with crankcase oil, the pulley side bearing is lubricated by transmission gear lube brought up by the reduction gear, and the two lubricants are separated by the AH583R pulley side seal (2) that part of the camshaft supporting the clutch operating sleeve and pulley bushing also receives lube via the reduction gear, and (3) the remainder of this shaft is operated dry.

Changing seasons and temperatures, together with heating and cooling of the tractor, cause condensation and eventually an accumulation of water in the main transmission case. This water breaks down the lubricating quality of the oil and is one reason why transmission oil should be changed at regular intervals. Spring is the best time of the year to change oil.

Success of the upper transmission's oiling system is dependent on the owner and his maintenance program. If oil is low in the case, there will generally be none available for pick up by the reduction gear. A 1/4-inch NPT plug is located to the rear of the flywheel. It is 12 inches back and 1-1/2 inches lower than the engine oil level test cock; six inches below the sliding shaft (Figure 115, Ch 1). Removing this plug opens a half-inch diameter oil-level test hole for the transmission and differential cavity. Gear lube should be maintained at this level. **BEWARE HOWEVER!** Condensation of water into the main case may provide a false indication! To ensure adequate transmission lubrication, change oil annually* and aggressively investigate leaks intent on making timely repairs. At risk are the elements of the sliding shaft, belt pulley bushing and pulley side camshaft bearing. (* At least check for contamination annually!)

Note to the Restorer -- Carefully inspect the bearings and bearing surfaces of the tapered roller bearings that carry the ends of the sliding shaft, and be diligent in evaluating the belt pulley bushing, and both camshaft bearings. Criteria for wear of the pulley bushing is that it shall have a "free running fit". This becomes a "machinist's tolerance" issue. For the layman, any discernable side-play is too much, and if noted, the bushing should be renewed. See also Appendix 7, bearings and bushings. See "Clutch Inspection Points" in Chapter 3.

Transmission and Final Drive - Disassembly

Planning -- Make A Chart -- Certain tasks need to be performed in a specific sequence. As assemblies and subassemblies are removed, store them for control and protection and to keep your work area in order. Determine what work is needed and when it is needed to be done. Schedule those tasks you plan to hire out in a pattern that supports your work plan. As work proceeds and components are removed, be diligent to **Journal** all findings that your inspecting eye uncovers.

Once transmission disassembly is complete and you have removed the rear axle assemblies (Steps 1 through 9 below), several jobs can proceed in parallel. They are: (1) rebuilding the gear shifter assembly, (2) renewal of AH633R oil seals in the main case and perhaps the bearing cups, (3) rebuilding (as needed) of subassemblies removed from the transmission (R/R of bad gears, bushings, etc.), (4) rebuilding the power shaft assembly -- usually bearings, a seal, and straighten the flipper guard and, (5) tear down, repair and rebuild of both rear axle assemblies -- the most major of all subassemblies. Throughout these steps, CLEAN, prepare for paint, and prime paint pieces. The objective remains the same. Keep thinking on the plan you have for your tractor; what it will look like, sound like, and smell like, and most of all what you will do at each stage to reverse the years of wear, a bite at a time!

While there will be points where any number of things can be worked in parallel, there are also sequences or orders of things to follow as well. During rebuild, complete your work on the transmission before installing the differential and rear axles. Also, the differential and rear axles must be installed before installing the power shaft/rear cover subassembly. Wheels are reinstalled on the tractor in ways and at times to support the need to move the beast. Wheels will be addressed in the "Basic Tractor" chapter, but are also a major item of your restoration.

Primary and Alternate Steps -- Total dismantling of the transmission is not absolutely necessary in order to perform needed inspections, verifications and/or adjustments to assure transmission serviceability. **Steps 5, 7** and **8** below have primary steps that if successfully performed, will allow you to bypass the companion alternate step. Cleaning is a very important objective of the restoration process. If there is an internal blockage of dirt and sludge that you cannot reach because not removing a certain shaft assembly, then remove it! That main casting needs to be squeaky clean.

Safety First -- During disassembly, the rear wheels will be removed. It is assumed, regardless of how much of the front of the tractor has been removed, that the Front End Support Frame remains in place and can be relied upon to support the frontal weight of the tractor. Stability must be maintained to avoid a tip-over.

Preparation -- Fabricate a cross support beam from a strong section of 4 x 4 wood approx 48-inches long, and if you can tolerate this beam being a bit longer, all the better. Buy an 8-foot pressure treated 4 x 4 from which to cut this section; nice and strong, it provides super safety at a reasonable cost! Bore two holes 3/4 inch diameter and 9-inches apart; this pair of holes is to be located roughly equidistant from each end. You will also need shims between the cross support beam and main case to accommodate the downward curvature of the main case casting. An excellent choice is 5/8 inch flat washers (18 -20 per side) for shims! The concept is that once the drawbar is removed, a cross support beam with shims is **bolted** to the main case using the rear hole pair. Use a pair of **5/8 x 6-1/2** inch machine bolts with flat washers. The beam is to provide stable blocking of the tractor as the rear wheels and axle assemblies are removed. See full illustrations in Appendix 12.

Special Tooling -- Gather hydraulic jack (minimum capacity two tons) and sufficient 2 x 4 and 4 x 4 chock blocks for jacking and blocking the tractor up. An air impact wrench with 1/2-inch drive will come in handy as well.

Inspection Criteria -- The Detective's Role -- Evaluation of individual parts of your tractor is an ongoing event. Recall that Renewal or Restoration is all about recovery from wear. Be vigilant in looking for evidence of wear and tear, and for any other result that makes the tractor not new. Journal your findings! Journaling it obliges you to deal with the issue sooner or later!

Inspect bearings for missing balls or rollers, rust pitting or corrosion pocks on bearing surfaces and for wear or deformation of the separator cage. Look for a general smoothness, firmness of assembly, and yet -- freedom of movement for all bearing parts. Check bearing cups for smoothness, and no cracks, pits or pocks.

Inspect bushings and shafts for wear, fit and cracks. Look for missing bushings (Your Parts Catalog comes in handy here). For bushings a 0.002 to 0.004 inch operating clearance is a good rule of thumb and will provide a "snug fit".

Gears must not have missing teeth, and tooth wear must be uniform. Uneven tooth wear needs to be traced for cause, the cause rectified, and those gears renewed. Over 20% loss of width (wear) is a turning point beyond which replacement is warranted. Wear in gear teeth to a point where smoothness is lost is a failed gear. Where backlash is called for, it shall be observable, but only sufficient to be discernable to the touch.

Inspect threaded parts and fasteners for "riveting", cross-threading and burrs. All must be reparable to original specifications or replaced. Unserviceable threaded tapped holes in castings shall be over-bored and fitted with suitable helicoil inserts. Standard torque values and specific torque call-outs assume NEW THREAD conditions, i.e., clean and undamaged threads. Examine every part of every casting for cracks, and for missing pieces. Repairs made to castings (in years long passed) are to be re-examined for continued serviceability.

Inspect every single item of hardware in the tractor right down to weldments and yoke or clevis pins. Make a reuse, repair or replace decision for each. Where more specific criteria apply, you will need to find the added data in that specific section, e.g., gear meshing, end-play, free rotation, backlash, or bearing loading requirements. See also Appendix 7.

1. Remove Drawbar, Clean Belly Region, Install Cross Support(s) and Remove Rear Wheels.

Remove the drawbar and support from tractor and drain fluids from the differential cavity. Clean the bottom of the main case once drawbar is removed. This will be your only chance prior to readiness for painting! Attach the cross support beam with shims to main case, rear hole pair, using a pair of 5/8 x 6-1/2 inches long cap screws with 5/8 inch flat washers as needed. [See **Preparation** (prior page) and Appendix 12 for details on cross support beam].

Jack tractor up and remove one rear wheel. Block side up with chock blocks under cross support. NOTE: Place blocking toward the (outer) end of the cross support to increase stability. Repeat this step for removing the second rear wheel and block the second side under cross supports. [See Appendix 12 for expanded discussion of removing rear wheels, and how to handle those stubborn, rusted wheel hubs].

2. Remove Top Transmission Cover -- Remove the five 3/8 x 1 inch cap screws, and lift away the cover with steering support shaft and gear shifter assembly.

3. Remove Rear Transmission Cover and Power Shaft -- (a) Remove seat from the seat support channel. (b) Remove as a unit: seat casting, spring and support assembly. (c) Remove two 7/16 x 1 inch cap screws that retain platform to main case, and remove center cap screw holding PTO Shield (just under the PTO shaft). (d) Withdraw the platform and Master PTO shield assembly, as a unit, from tractor. (e) Remove cap screws retaining rear differential gear cover to main case. (f) Withdraw rear cover and power shaft, as a unit, from rear of tractor. NOTE: If the power shaft system has a master shield but no flipper guard, the power shaft and rear cover can be removed without first removing the seat and platform because the bolts (master shield-to-platform) are accessible. .

4. Remove Rear Axle Housing Assemblies and Differential -- (a) Remove the six 1/2 x 1-1/2 inch cap screws retaining axle housing to transmission case. (b) Withdraw the axle assembly [2 man job, or a hoist]. (c) Repeat for second axle housing assembly. (d) Withdraw differential from rear of cavity.

5. (Primary Step) Clean up Shifter Shaft Bearing, PC304, page 24, Upper Figure -- The objective of this step is to ensure the position of the shifter shaft can be adjusted. Remove set screw (1) and its lock nut (2), the adjusting screw (5) and its lock nut (6), remove the bearing mounting cap screws (4) and withdraw bearing. Thoroughly clean and inspect bearing and its parts, and the parts of the entire assembly. Reinstall bearing and its associated hardware along with new gasket (9). Inspection failure of the shaft or the shifters will take you to step 5a below. <u>If all is well, proceed to step 6</u>.

5a. (Alternate Step) Remove Shifter Shaft and Shifters -- (a) Slide shifter (11) along shifter shaft (10) until the pawl (19) rises. (b) Install cotter pin (or nail) in the hole in the shifter pawl to lock the pawl in the raised position. (c) Unbolt the shifter shaft bearing (8) from left side of main case. (d) Withdraw bearing and shaft thru left side of main case. Withdraw shifters (11 and 17) from above thru transmission's top opening, store all parts as a subassembly.

NOTE -- Shifter pawls may not have holes for pins. See note under transmission build up, **shifter shaft**.

6. Remove Sliding Gear Shaft, PC304, page 25 -- (a) With reduction gear already removed, remove cap screws (18) retaining sliding gear shaft pulley-side bearing housing. (b) Remove bearing housing (16). (c) Remove left bearing housing, and then remove nut, washer, bearing and bevel gear (PTO tractor) from left end of shaft. (d) Withdraw shaft assembly through opening in right side of main case, store parts as a subassembly. **Journal** (keep track of) shims (15) on right side bearing housing and gasket/shim (4) on left side bearing housing to have a starting reference point for bearing preload on reassembly. Shims must remove all shaft end play on reassembly and correctly set the PTO bevel gear backlash.

7. (Primary Step) Countershaft and Gears, PC304, page 24, Lower Figure -- Inspect gears for condition of teeth, pinion bearings for excess play, and then -- their relationships. There should be no end play between gears and pinion. That is, gears are to be retained rigidly on the pinion. Snap rings (3) of various thicknesses are used to perform this function. Verify that thrust washers (2) are in place at each end of the gears assembly. If renewal of any part is needed, go to step 7a below. <u>If all is well, proceed to step 8</u>.

7a. (Alternate Step) Remove Countershaft and Gears -- (a) Remove screw and lock plate (13 and 14) that retains shaft to pulley side of main case. (b) Withdraw shaft through pulley side of case. (c) Bring gears, washers and spacers through rear opening of main case, store parts as a subassembly.

8. (Primary Step) Reverse Gear and Shaft, PC304, page 24 Lower Figure -- Inspect gears for condition of teeth, and then inspect the relationship between the reverse gear with its bushing (9 and 10) and the reverse shaft (11). Criteria here calls for a "free running fit", which implies free rotation, but also a lack of

excess play between the bushed gear and shaft. Discernable radial motion is too much! If renewal of the bushing is needed, go to step 8a. If all is well, proceed to step 9.

8a. (Alternate Step) Remove Reverse Gear and Shaft -- The reverse shaft (11) is retained by sliding gear shaft pulley-side bearing housing (PC304, page 25-16), removed during paragraph 6 above. (a) Withdraw reverse shaft through pulley side of case, and (b) withdraw gear from above, store parts as a subassembly.

9. Disassembly of the Differential (PC304, page 26 and FSB 141-S, 1-15-43) -- The differential is the crossroad of forces being transmitted to the rear axles by both the transmission and the brakes. Sudden application of the brake in a "one wheel spinning" situation shoots a shock load through those little gears that would be difficult to calculate. Mechanical stress is worse in colder climates because of increased brittleness. Tractors of this size were ideal for manure spreaders and often used on frozen, slippery, rutted terrain. It turns out that the "H" differential has a rather interesting history. A pattern or history of sheared differential bolts invites a very close inspection of the bolts, bevel gears and thrust washers. Late in production (two-thirds of all "H" tractors had been shipped), the decision (reflected in FSB 141-S, 1-15-43) was made to increase bolt size from 7/16-inch diameter to one-half inch. Implementation of that decision is another story. Read on.

Check the differential bolts in PC-304, pg. 26. Whether yours are 7/16 or ½ inch diameter, ensure the bolts are not partially sheared. If evidence of shearing is found, totally renew all six bolts with like-size and with grade 5 stock.

Those bolts (H959R individually, AH1066 set of 6 w/nuts) are ½ x 2 inch. However, the original H135R (7/16 x 1-3/4 inch) and the associated holes in the differential and final gear were sized for the 7/16 inch diameter bolts, furnished from the factory from Day One through H-41465. Apparently, the 7/16 inch bolts weren't strong enough. A notice contained in **FSB 141-S (1-15-43)** explains the remedy.

a. Deere & Co. changed the bolt size in production tractors starting with S/N H-41466.

b. They then completely eliminated the H135R (7/16 x 1-3/4 inch) bolts and associated H128R differential and the H129R final gear. These part numbers are ELIMINATED from the data base!

c. For service requirements, they offered three new packages.

(1) One package was six new ½ inch bolts (AH1066R). The idea here was that if only the original 7/16 inch bolts were compromised, the service department would drill out the holes in both the differential and the gear to fit the new ½ inch bolts.

(2) The second package was a new differential case with large holes and six new ½ inch bolts and nuts (AH1064R). In this case, the service department would have to drill out the holes in the final gear.

(3) The third package was a new final gear with large holes and six new ½ inch bolts and nuts (AH1065R). In this case, as you have guessed by now, the service department would have to drill out the holes in the differential case to make things fit.

Interesting to note that Deere decided to "kill" a design problem by refusing to continue furnishing the 7/16 inch bolts as repair parts, and they also discontinued the differential and the final gear with 7/16 inch bolt holes. Instead, people were forced to go to all new or modified parts even if it might not have been necessary in all cases. Sounds like a situation where the **factory service management** got tired of complaints about this "shortcoming" and decided to make a rather aggressive fix!

Rebuilding the Gear Shift

(H-10000-up)

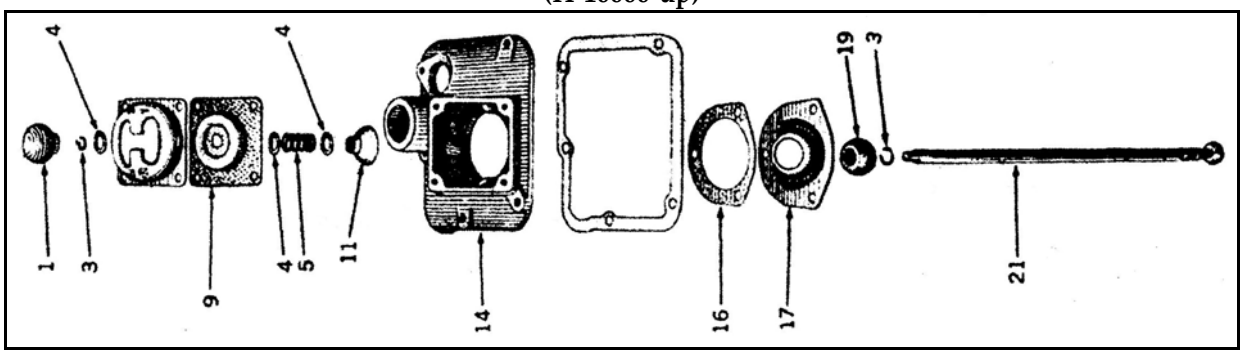


Figure 406. The Series "H" Gear Shift

The initial discrepancy report item read something to the effect: "Found H378R cover (11) and H718R socket (17) rusted to smithereens". Before it was over, nearly every item along the H722R lever (21) was replaced except the lever itself and the knob (1). Even the lever was machined some! Truly, this was a worst-case rust bucket.

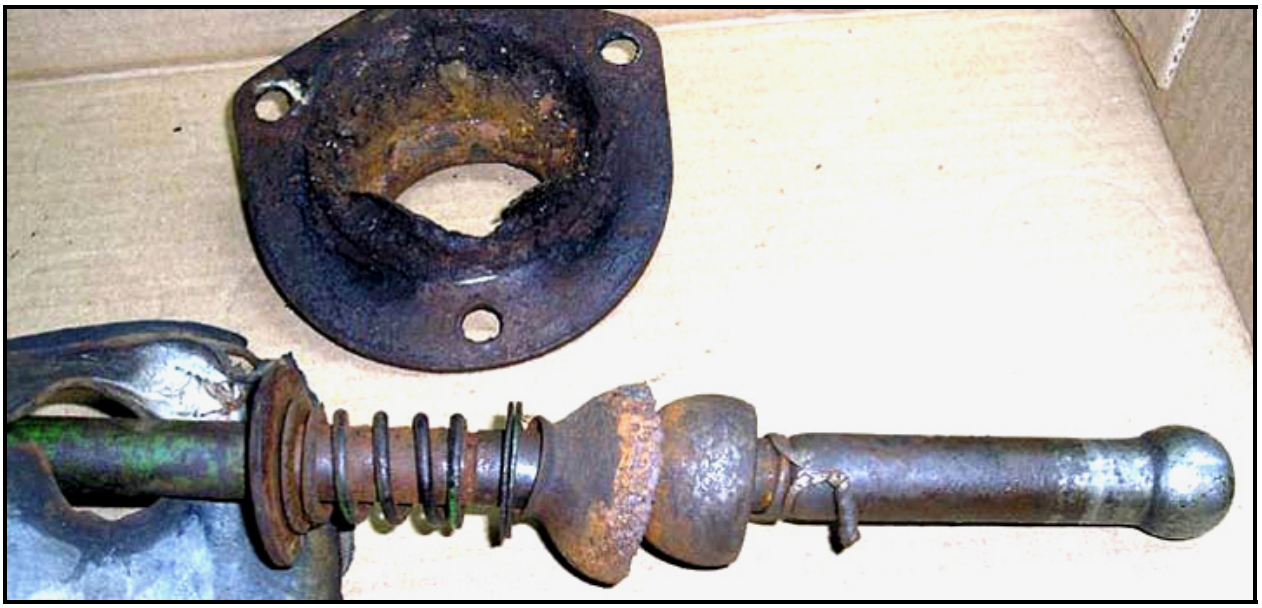


Figure 407. A Better-than-Average Find!

Work began with PB Blaster applied, followed by a soak, then heat along with patience and persuasion for total disassembly which included removal of H717R ball (19). The ball was so deeply pitted that it was beyond recognition had it not been on the lever!

On the H722R lever (21), you should find two grooves milled into the lever that are to accept B387R snap rings (3). This interface is the design weakness of this tractor's gear shifter, and of the A's and B's (1941 and up) and all the G's out there too! The snap ring, as a result of age, is no longer a good match for the groove - if it ever was. The most widely accepted work-around in the John Deere Restoring Community is to weld a modified 5/8 inch lock washer (bent straight) in for a snap ring at the lower groove; this being just under the H717R ball for the JD "H" tractor. I am told this same fix is to be used for the upper groove as well, but I found an upper welding fix to be impractical because it makes final assembly extremely difficult. You have to have welding capability and perform final assembly at the same time, same place!

Figure 408 (A&B). External Clip EC-62 in Use, and Compared with B387R

Rather than a second weld, a decision was made to have the upper groove slightly enhanced on a lathe. The machinist found the lever to be very tough and hard indeed! At any rate, so little was removed that it is fair to say the upper groove was "cleaned up" on the lathe. It was soon learned, however, that the B387R snap ring still would not hold even after "enhancement" of the upper groove. Some experimentation and struggle brought forth a solution in the form of a **5/8 inch External Clip**. It did the job nicely. The clip is not quite as thick as the B387R and it fits into the lever groove much better.

The Order of Things -- With lessons learned, a complete inventory of parts on hand, and a H723R (9) leather seal that was conditioned with a light leather oil, final assembly of the gear shift subassembly can proceed. It is imperative that the H701R/H702R casting (14) IS NOT involved until AFTER the upper snap ring (now an EC-clip) is in place. **Begin**: Weld modified 5/8 inch lock washer in place of the lower B387R snap ring, and then (in order ref fig 406), onto the H722R lever shaft (21), install H717R ball (19), H718R socket (17), H719R gasket (16-dry), H378R cover (11), B2274R washer (4), D377R spring (5), B2274R washer (4), H723R leather seal with it's crown up (9), and B2274R washer (4). You are now ready for a compression job!

Pretreatment -- Treatment of the H723R leather seal (boot) is best done with Neats-foot Oil. However, readers are having trouble finding this product. Also, many commercial so-called Neats-foot products contain substantial amounts of petroleum additives. Thus, a two or three-day soak of the H723R in ordinary engine oil will generally prove satisfactory.

Compression -- Once again, **special tooling** comes into play. See figure 409A. Here, a combination was used a 3/8 x 6 inch machine bolt with two nuts to hold a **5/8 inch crowfoot wrench** with 3/8 inch drive, a bench vise, and a person to help. I inserted one end of the stack-up into the crowfoot wrench and applied pressure sufficient to compress all elements installed on the lever while my helper snapped the EC-62 external clip into place. Removal (straight up) is all that remained, and it went like clockwork.

To put a wrap on final assembly, insert lever subassembly up thru H701R/702R casting, being gentle with H723R leather seal as you work it up thru the casting. Flip this group over. Then bolt and safety wire H719R gasket and H718R socket to casting (no Permatex needed here). See figure 409B.

Back upright, temporarily install 5/16 x 9/16 inch long cap screws to secure H723R leather to transmission cover (H701R or H702R). See figure 408A.

All that remains is installation of H721R quadrant and F292R shift ball, both left to one's discretion,

depending on the relevant "final assembly and paint plan". Unit is otherwise complete.

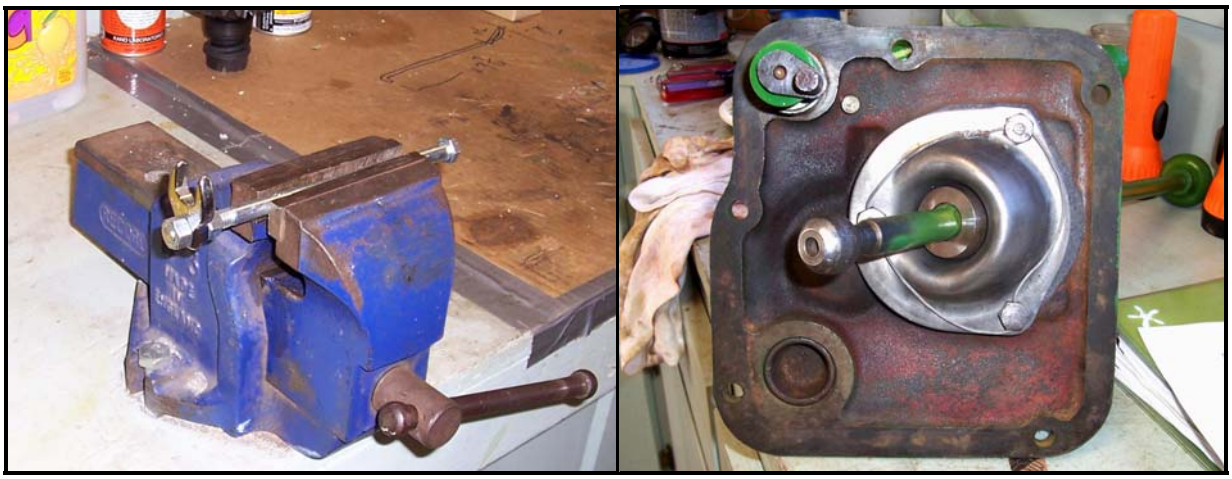


Figure 409 (A&B). A - Crowfoot Wrench w/bolt, B - Socket Safety-Wired in Place

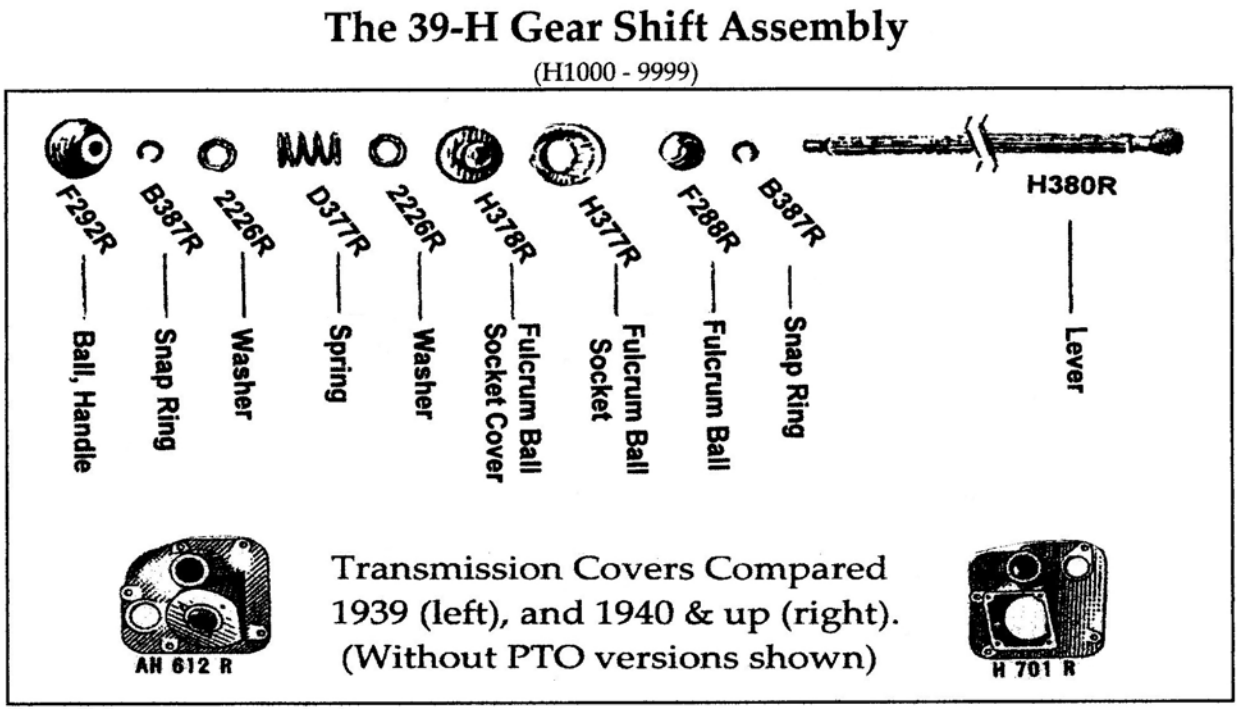


Figure 409C. The Gear Shift Illustrated - 1939

Shown in figure 409C (at left - above) is the transmission cover with H377R fulcrum ball socket installed. This socket is a near-press-fit into the cover, making removal a bit of a challenge. To remove the gear shift assembly, remove the F292R ball handle (The handle unscrews from the gear shift lever), and remove the three small cap screws securing quadrant. Lift quadrant away. Reinstall the F292R ball handle to assist in removal of the gear shift assembly which is not easy, and is best done by means of penetrating fluids, moderate heat, and gentle tapping and prying around the outside of the fulcrum ball socket. One fellow told me, " The only way I got mine to move was reinstalling the ball handle, pulling with all my might and then taping with hammer on underside of ball handle. Once I got it out and cleaned then it goes in and out much easier."

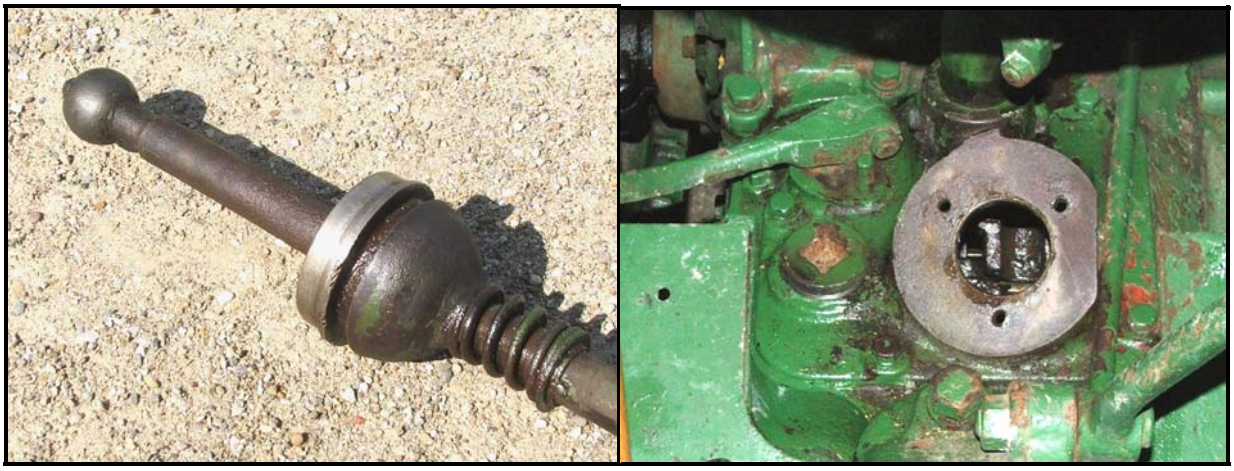


Figure 409 (D&E). 39-H Gear Shift Assembly (left) and Transmission cover port (right)

Trouble with the B387R snap rings? This is not unusual. For the bottom, it is becoming customary to spot-weld a ring in place. The ring can be an old B387R snap ring, or a 5/8" lock washer with the bend taken out of it. For the top snap ring, a few choices exist. If you are real adept with a small Dremel™ type grinding disk, you might try enhancing the groove in the gear shift lever. There is the EC-62 External Clip solution as outlined in the basic text. One enterprising fellow proposed drilling at the groove so as to insert a cotter pin (tricky at best - and may weaken the gear shift lever at a critical point).

Once inspection and repairs are completed, reinstall by reversing disassembly steps above. Ensure the fulcrum ball, its socket and cover are well treated with bearing grease during build-up. Apply a coating of Permatex 2B™ (or equivalent) to the interface of the fulcrum ball socket and transmission cover. You will note that the three holes for mounting the quadrant are not symmetrical. The quadrant piece will fit only one way. In the unlikely event the quadrant base plate breaks away from the "top hat" part, observe the "up" orientation of the base plate BEFORE welding so that its "up" direction is coincident with the "up" direction of the "top hat".

Removal and Replacement of Inner Seals

AH633R, and Inspect/Renew Bearing Cups

To gain access

a. Lube is drained from transmission and final drive cavity
b. Rear cover is removed from the main case.
c. Have the tractor stabilized per earlier remarks in this chapter and Appendix 12.
d. Both axle housing assemblies are removed. Use CAUTION!
e. The differential is removed and set aside.

Remove AH633R Oil Seals (Victor P/N 49501, National P/N 455137), Figure 410A --

Reference is PC304, page 27 -- OBSERVE: Once the rear axle assembly is removed, the bearing cup (28), seal retainer (29) and the oil seal (30) remain in the main case casting.

Remove washer-like H445R retainers (29). A carpenter's pinch bar (some call it a wrecking bar) that is approximately 30-inches long works well for retainer and seal removal. Just engage the spade end and pry the piece out. **Journal** the orientation of this concave washer-like retainer. The outer edge points INTO the main case. Plan to straighten and reuse retainers because replacements are no longer available

from Deere & Co. NOTE: Do not take the concavity out of the retainer, simply restore it to an "un-distorted" state.

Remove old seal (30). **Journal** the orientation of the seal. Note that the oil lip will point INTO the main case. Clean area with wire brush, or suitable equivalent. Ensure the seal area is free of contaminants and/or snags that could damage the new seal. Apply some light oil to protect from oxidation.

Inspect Bearing Cups -- Renew as Needed -- Carefully examine bearing cup (28), left and right. Reject if surface is pitted, cracked, or has lost its smoothness for any reason. Great care must be taken when driving the bearing cup out. See figure 410A and observe that the casting contains an inner snap ring on each side. This is the "installation stop" for the bearing cup. When you install the new bearing cups, take the cup to the snap ring, and stop. A casting breakout would be a disaster, and demand repair. Breakouts like this usually warrant replacing the main case casting!

Figure 410 (A&B). H444R Snap rings not illustrated in PC304 (left), and part of rear axle assembly.

~ WARNINGS ~

Ref figure 410. The bearing cup for the inner axle bearing is stopped by an inner snap ring. This inside snap ring is stopped by a very fragile but vital part of the main case casting. It will break! See notes:

1. When removing the old bearing cup, drive it out from the opposite side with a tool that will catch the bearing cup and NOT the snap ring.

2. When reinstalling axle housing assemblies, use a strap wrench (or pipe wrench with old shoe leather or belting to protect the axle spines) to rotate the axle as the housing cap screws are drawn tight to guard against applying a destructive force against the snap rings. This is a good time for a helper!

Install Oil Seal and Retainer -- Apply several drops of engine oil to area receiving seal; smear around. Install new AH633R seal, OIL LIP IN, using appropriate tooling; never strike a seal with hammer! A short 4 x 4 with a square-cut end, and its corners knocked down (slightly rounded to fit) works out quite well.

Install H445R retainer, concavity (domed side) outward, outer pointed edge INWARD. Suitable tool here is a driving punch once retainer is engaged; drive until firmly seated evenly into receiving cup.

Unless there are other actions to be performed on the Final Drive sections of the tractor, close this operation by reversing the steps "to gain access" above.

Transmission Subassembly Full Inspection, Renewal and Reinstallation

(See JD-H Transmission pictorial, Excerpt from FSB 99-S, 07-15-39 at end of chapter)

Cleaning -- Ensure all dirt and sludge is removed from main case before proceeding, to include the small oil return paths found in and around the sliding shaft mounting area.

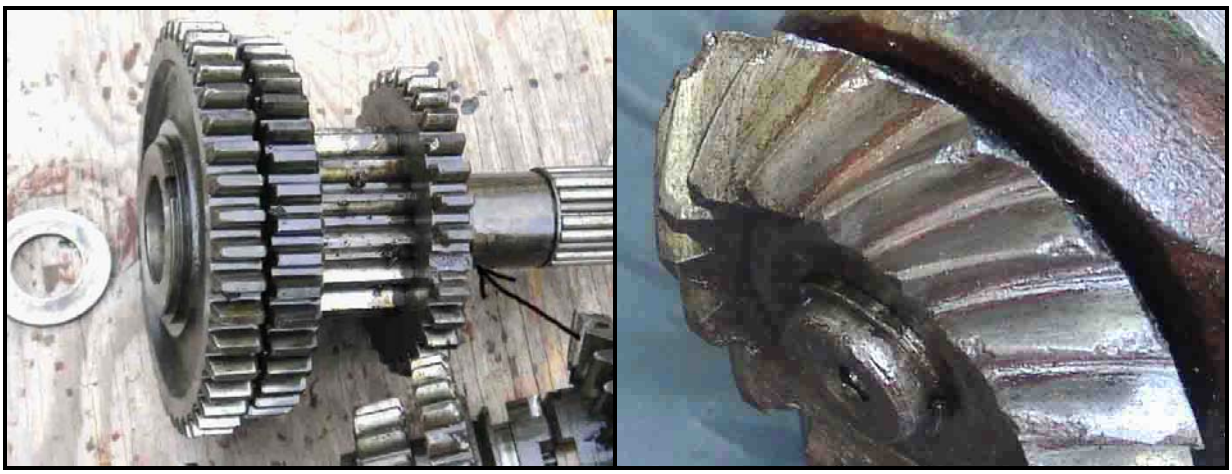


Figure 411 (A&B). Tooth Missing from High Gear, and Fan Shaft Gear worn and Chipped.

Gear Criteria -- Most of the defects you will find for subassemblies within the transmission will be with gears. They will be missing teeth, have "snaggle teeth" where (on the same gear) some teeth are chipped at the edge and some are not, or gear teeth may be so worn as to have lost any width at the tip or end of each tooth. See Figure 411 (A&B).

1. Install Reverse Gear and Shaft (PC304, page 24 - Lower Figure) -- The AH1201R Reverse Gear Assembly (9) with Bushings (10) must be inspected to criteria contained in this chapter. Renew any unserviceable parts.

Installation -- If new AH668R (10) bushings are installed in the Reverse Gear Assembly, hone or ream, if necessary, to obtain a free running fit of the reverse gear on the reverse shaft (15). Apply a thin coating of spray lube into bushings and onto shaft. Generally position the reverse gear and insert the reverse gear shaft, from pulley side of the main case, into case to engage the gear. Shaft should seat flush with edge of main case, pulley side. Recheck to ensure a free running fit of gear on shaft.

2. Install Countershaft and Gear Set (PC304, page 24 - Lower Figure) -- Pinion gears and bearings must be inspected to criteria contained in this chapter. Renew any unserviceable parts.

Notes: (a) The three forward drive gears (4, 7, and 8) are keyed onto the pinion (5) using H1045R key (smaller one) for the (4) gear and H1044R key (longer one) for the (7 and 8) gears. (b) For tractors S/N 2210 and below, H620R spacer washer is to be placed between the two (7 and 8) gears. (c) The snap rings (Item #3) were originally available in three different thickness' and a ring was chosen during assembly at the factory to ensure the gears are retained rigidly on the pinion -- there is no "free roam". Thus, you may find the two rings to be different.

To install gears on pinion -- Install high-speed gear (4) and key (18) onto pinion (5); press in place. Select and install snap ring (3) of thickness that will retain this gear rigidly on the pinion.

Install intermediate-speed gear (7) and key (6) onto pinion; press in all the way. If tractor S/N is 2210 or below, install (next) H620R spacer washer (19). Then, install low-speed gear (8) onto pinion per key (6); press in place. Select and install snap ring (3) of thickness that will retain the two gears rigidly on pinion.

To install pinion with gears and countershaft -- Insert bearings (16) and bearing spacer (17) into pinion. Insert H148R (15) countershaft into main case only far enough to install thrust washer (2) onto shaft. Position pinion assembly and continue to insert countershaft, engaging the pinion assembly.

TIP: A slight increase in the amount of chamfer on shaft end will make insertion easier and reduce chances of damaging the JD7915 roller bearing cages.

As countershaft nears the end of its travel, insert the second thrust washer between pinion assembly and main case, and bring countershaft the remaining distance (inward) engaging the second thrust washer. Position countershaft as required and install screw and lock plate (13, 14). Safety wire screw in place (12). Apply a thin coating of spray lube onto pinion, gears and shaft.

3. Install Sliding Gears and Shaft (PC304, page 25) -- The shaft, gears and bearings must be inspected to criteria contained in this chapter. Renew any unserviceable parts.

Installation -- The sliding gear shaft assembly must be bench-assembled, then put into the main case.

Apply a thin coating of spray lube onto shaft and gears. Install JD7262 bearing cup (14) into H157R/H784R bearing housing (16); and left-side bearing cup (7) into H161R/H785R bearing housing (1).

Observing order and orientation, install the two pinions (11) and (12) onto shaft (10), and after pinions, install bearing (13), and temporarily install nut (20).

For tractors with PTO, install collar (PC304, page 28-32) and bevel gear assembly (PC304, page 28-20).

Install thrust washer (9), bearing (8), install and secure nut (5), and cotter pin (6).

Insert sliding gear assembly (smaller end leading) through opening on right side of main case.

NOTE: For Tractors with PTO, the bevel gear assembly (PC304, page 28-32) is fitted with a bushing (PC304, page 28-21) which can be renewed and honed or reamed as necessary to achieve a "free fit" on the sliding shaft.

Bearing Load Analysis -- Observe that the sliding shaft is supported in place by tapered roller bearings (cone and cup bearings or "Timken" bearings) at each end. Thus, the thickness of gaskets and shims between bearing housing and case are, in effect, adjustments for loading these bearings. The thickness between pulley side bearing housing (16) and case is varied to remove all bearing play yet permitting shaft to rotate freely. The thickness of gaskets and shims between flywheel side bearing housing (1) and case are varied to control the position of the PTO Driving bevel gear in relation to the bevel gear on the power shaft. This adjustment to be revisited when installing power shaft.

Bearing Load Adjustment -- Install bearing housing (1) with a thick gasket, a shim, and a thin gasket (4) without sealer, and tighten. Next, install bearing housing (16) and vary the thickness of gaskets and shims (15) to remove all bearing play but permit shaft to turn freely. Secure and safety wire slotted hex

head cap screws. For a tractor with PTO, you may have to revisit, and if so, revisit the safety wire task as well.

Note: The shims (4) are later adjusted to present heel-to-heel registry between the PTO drive gear and the driven PTO gear (PC304, page 28-20 and 38). The thickness added to or removed from (4) must be removed from or added to (15). This adjustment is to be done AFTER the bearing load adjustment above.

4. Install Shifter Shaft and Shifters (PC304, page 24 - Upper Figure) -- The shaft, shifters and yokes of this assembly must be inspected to criteria contained in this chapter. Renew any unserviceable parts.

Installation -- Using a smoothly blunted tool, depress the shifter pawl (19) into each shifter (11, and 17) and insert a cotter pin (or nail) to lock each pawl in its raised position. Apply light coat of lubricating oil on shaft (10) and into shifters (11, and 17).

---------- **Special Case** ----------

Finding -- Not all F3362R Shifter Pawls will have a drilled hole so that they can be locked into the raised position, making this installation a tough challenge for the one-timer. One solution is to secure a 15-20 inch long piece of 0.7500 round bar stock, chamfer one end at a nice long angle of (say) 30°. The very end can be blunted for safety reasons, and you should polish it up a small bit; at minimum, remove all burrs. On the other end, it would be helpful to attach a short tee-handle.

Directions for Use -- Install shifters, low and reverse gear then intermediate and high gear by inserting chamfered shaft from the right side of the tractor. Use rotary motion of the chamfered bar to work open the pawl as you come to it in each shifter. Once both shifters are installed and chamfered shaft is inserted all the way and extending a bit outside main case left side, turn the inserted tool so that the chamfer faces AWAY from the pawls. Now grasp the shifter shaft. Orient all notches of the shifter shaft toward the front of the tractor and slightly up so they do not come in contact with the pawls as the shaft is inserted. With a smooth continuous motion, now use the shifter shaft to push the chamfered shaft out of the tractor, and Presto -- You have overcome the detent pawls! All that remains at this point is to rotate the shifter shaft to its design position, adjust as needed, and secure the shaft.

Alternate Solution -- Yet another idea to overcome shifter pawls not having holes drilled is to use a small hose clamp to hold the pawl OUT of the channel so the shifter shaft will slide through without touching them!

---------- **End of Special Case** ----------

Insert shaft (10) thru flywheel side of main case, and into shifters (11) and (17); note shifter engagement as follows: (11) with high and intermediate pinion (PC304, page 25-11); and shifter (17) with low and reverse pinion (PC304, page 25-12).

Mount shaft bearing (8) and gasket (9) onto shaft using 3/8 x1 inch hex head cap screws and lock washers (3 and 4). Remove cotter pins (or nails) from shifter pawls. Move shifter (11) along shaft until pawl engages a detent (establishes shaft rotation orientation). Install but do not tighten set screw (1) and lock nut (2).

Shifter Adjustment -- Install adjusting screw (7) and adjust so that gears on the sliding gear shaft mesh evenly with gears on the countershaft when shifted into drive position. Secure adjusting screw (7) with 5/16 hex head cap screw (5) and washer (6). Tighten set screw (1) and its lock nut (2).

5. Install Power Shaft Shifter -- See PC304, page 28 -- The shaft (18) and shifter with yoke (16) of this assembly must be inspected to criteria contained in this chapter. Parts found bent out of shape are to be renewed.

Installation -- Apply light coat of spray lube to shifter with yoke (16) and shaft (18). Apply anti-seize compound to the thread of the shaft. Holding shifter with yoke in detent with collar (32) on sliding shaft, install shifter shaft being CAREFUL not to cross-thread shaft as it is being turned into main case. Draw shaft into main case securely.

NOTE -- In many instances, the H724R shaft will be bent, and this will show up while you are turning it into the main case. DO NOT attempt to straighten it while install by striking for fear of damaging the main case. RECOMMEND installation so that in its final position, the shaft does no angle upward! An upward angle will reduce engagement of collar with driving gear; the result a tendency to disengage.

The John Deere "H" Power Shaft

OBSERVATION: Unlike other tractors, the JD-H power shaft with bearings and gear cannot be withdrawn as a unit from the tractor by simply removing the shaft's rear bearing housing from the differential cover casting. This statement refutes paragraph 222 of I&T Shop Service Manual JD-4.

The Method -- Remove and reinstall power shaft, bearings and gear assembly along with the H599R rear transmission cover as a single unit. Before initial removal, drain transmission oil from transmission and differential cavity of the main case.

Power Shaft Assembly Removal Inspection and Restoration

For tractors with PTO and MASTER SHIELD with FLIPPER GUARD, disconnect linkage at the bottom of the clutch lever, remove cap screws retaining H369R seat casting to main case, and lift away the seat and seat casting assembly plus clutch lever as a single unit. Remove two brake pedal springs, lower cap screw retaining master shield to rear transmission cover, remove cap screws retaining platform to main case and lift away platform, master shield and flipper guard as a single unit.

AT ISSUE -- The flipper guard prevents human access to the bottom side of the 5/16" stove bolt fasteners connecting the master shield to the platform. If you have no flipper guard, then there is no need to remove the seat assembly, nor the platform! Simply unbolt master shield from platform and rear cover.

For all tractors with PTO, begin by removing only the **UPPER LEFT** and **LOWER RIGHT** cap screws retaining rear cover to main case, and install **3/8 x 2-inch Guide Pins as replacements**. Then, remove remaining cap screws and withdraw driven shaft with bearings and gear, and the rear cover as a single unit. The Guide Pins will ensure straight-back removal. **See Fig. 412.**

CAUTION! Failure to withdraw combined assembly **straight back, on the Guide Pins** may result in sideways or up and down motion, and this motion which may fracture the power shaft forward bearing boss inside main case.

Rear Transmission/Differential Cover H599R -- Two holes in this cover are design as pilot holes, shown here with Guide Pins installed (3/8 x 2-inch pieces of 3/8-16 all-thread rod). Pilot hole diameter is less than the diameter of the remaining holes. Guide Pins are used for both removal and reinstallation of the power shaft/cover integration.

Use of Guide Pins serves to **ensure** direct, in-line motion of both cover and shaft for the entire length of the pins to protect the power shaft forward bearing boss in the main case.

TIP -- Use a third Guide Pin on the right side (at roughly 3:00 o'clock) during installation to hold gasket in place.

Figure 412. Rear cover for series H tractors with PTO

TIP: Preserve Data -- Measure and record thickness of gasket-shim thickness between rear bearing housing and H599R rear cover. Taking a micrometer reading resolute to 1/1000-inch is recommended. Absent a micrometer, bag and tag original combination to enable **replication** during reinstallation.

The Power Shaft -- See PC304, page 28 and Figure 413 -- The shaft (43), bevel gear (38), bearings (39 and 42), felt washer (48 or 61) and flipper guard (55) are to be inspected to the criteria contained in this chapter. At minimum, renew the felt washer and any unserviceable parts. To replace inner bearing, the gear (38) will need to be pulled off shaft (43) once cotter key and nut (37) are removed. Other aspects of tear-down and reassembly will become obvious as you get into the tasks at hand.

TIP -- Test the empty H599R casting for flatness. If not "sufficiently" flat, submit the casting to engine repair to be **milled to flatness** in order to avoid leaks following build-up. This is the only cover on series H tractors against which oil rests. No gasket can make up for a warp between cover and main case! The normal oil level is near the midpoint of the cover, with "splash" presence nearly up to the power shaft.

TIP: Removing Inside Snap Ring (small shaft) -- Stabilize the bearing housing. Then use a combination of tools. Two crisp, (near like new) screwdrivers, one very small one and one medium size will work quite well. Put the larger driver blade under one of the angled points of the ring and twist it, prying the point toward the center of the housing. Simultaneously stick the small screwdriver in the small gap that will form between the ring and the housing that will form. Then alternate the two drivers until it literally pops out. This method should not distort the snap ring. You should be able to use it again.

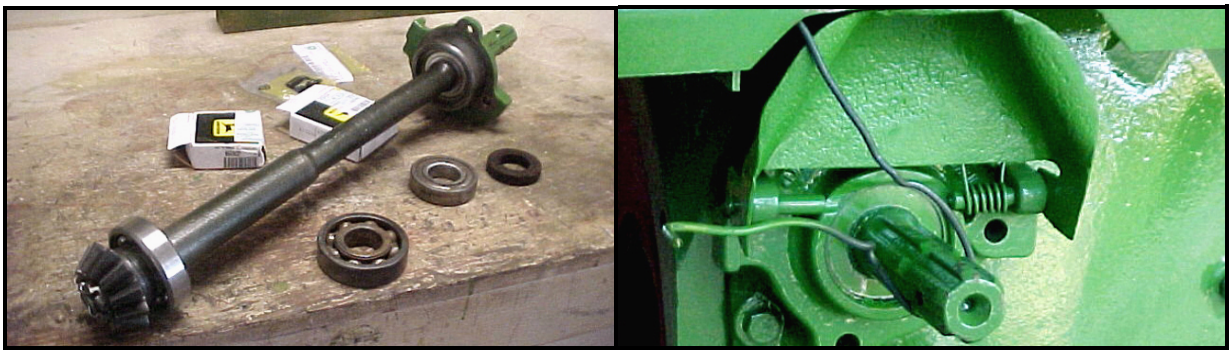


Figure 413 (A&B). Bearings and Felt Washer Renewed, Flipper is Straightened and Welded

TIPs -- Inside Snap Ring (large shaft) -- Figure 414. This hole provides access to dislodge huge inside snap ring. Reinstall the snap ring with an end within an inch from the hole to enable removal during later overhauls. Remember to reinstall the plug.

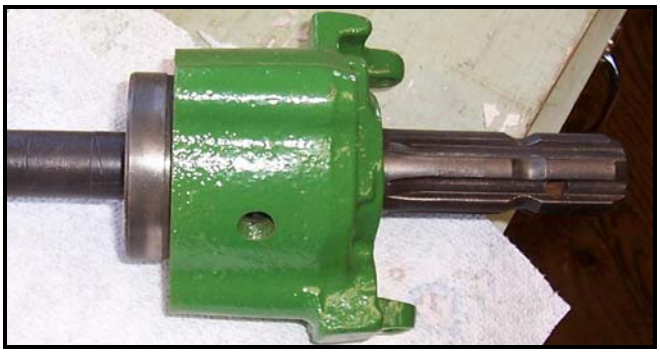


Figure 414, The Mystery Hole

Pack Rear Power Shaft Bearing -- Transmission oil doesn't arrive at this bearing sufficiently for its lubrication. When overhauling the power shaft assembly, clean and pack this bearing with high temperature grease (FSB 113-S, 9-15-40).

PTO Jumps out of Gear - A Frequent Complaint

Drive Collar Engagement with Driving Gear -- This trouble is a result of some changes in the variables controlling engagement of the drive collar to the drive gear. It can come as a result of a poorly dressed cotter pin, parts that are sprung out of original specification. Some will claim marginal design and/or quality control issues during the "H" era of 1939 through 1947.

Cotter Pin -- See PC304, page 28, key # 36, cotter pin. Be sure to dress cotter pin so that its legs do not extend beyond the end of the power shaft. When dressed otherwise, legs of the cotter pin can strike the shifting collar (key # 32) bringing the collar out-of-engagement with the driving gear (key # 20).

Parts out of Specification -- Other variables are a bent H724R shifter shaft, a bent AH715R/AH794R shifter with yoke assembly, or a twisted H612R crank. A stack-up of minor stresses in each part may also come into play and be very hard to isolate! Work the issues in this order to achieve a solution.

Bent PTO Shifter Shaft -- A service advisory issued in FSB 122 (6-15-41) states: "Do not attempt to engage the power shaft while the belt pulley is rotating. This causes a clashing of the power shaft shifting collar and drive gear interface, and if sufficient force is applied, this force will spring (bend) the PTO shifter fork shaft."

Speaking from personal experience, all but one of the used PTO shifter shafts I have ever purchased were bent! Trying to make a bent one straight again can be very difficult indeed. If yours is bent, find an angular position that provides shifting of the PTO drive collar into and out of gear without binding, but also such that it does not angle upward! An upward angle will reduce engagement of collar with driving gear.

Shifter with Yoke Assembly -- During build-up, the yoke and shifter assembly must be inspected to ensure a 90° (right angle) relationship remains between shifter shaft axis and yoke. Again, verify also that the H724R shifter shaft does not angle upward which would reduce shifter travel toward engagement.

Test Engagement

The Test -- For this test, the power shaft and rear cover assembly is not installed. Carefully and without gasket sealer, install top transmission cover and tighten (reasonably) at least two of the cap screws. From the rear, verify FULL ENGAGEMENT of drive collar and driving gear when the PTO shifter is moved to the "engaged" detent position. If the PTO shifter lever can be moved beyond detent, this indicates that corrective action is required.

Primary (Remaining) Cause -- The suspect is a twisted H612R crank, or at least a crank not getting the job done. And if this is determined not to be the issue, the relationship between the PTO Shifter lever and the H612R crank must be changed. This is done by fabricating an "offset key", or by fill-in of old slot and milling a new slot into the H612R crank. This is a job for a machinist.

Add PTO to a Non-PTO Tractor

If you are in need of a power shaft to drive implements such as a finish mower and your tractor was not so equipped, you may elect to install a PTO system. CAUTION: Before spending ANY money to purchase the parts you need, remove the rear differential cover and inspect to ensure the forward shaft bearing boss remains intact! For illustration of the bearing boss and an outline of what you will need and for precautions to take, see Appendix 11.

Power Shaft Assembly Installation and Adjustment

Power shaft installation and adjustment is independent of, and may be performed before or after installation and adjustments involving differential and rear axle assemblies (final drive). This operation must come, however, AFTER installation and initial adjustment of the transmission's sliding gear shaft assembly. This discussion assumes power shaft installation and adjustment is performed after transmission build-up and before final drive build-up, and the top transmission cover is not installed. Further assumed herein is that final closure of the main case is to come at a later time, thus gasket sealer is NOT called out for the H599R cover gasket in this sequence.

Overview -- This operation includes use of guide pins, combining power shaft assembly and H599R cover into a single unit, the H599R cover gasket, and establishing the working relationship between the PTO gears. Even the dry gasket is part of the adjustment procedure.

Preposition -- Whereas the bevel slope of the driven gear (close to 60-degrees) is more blunt than that of the driving gear (more like 30-degrees), it appears most appropriate to control gear heel by shim gaskets between the PTO rear bearing housing and rear cover (H599R). It then follows to control backlash by shim gaskets between the sliding shaft bearing housing and case.

The Approach -- Review your journal to refresh on original thickness of the shim-gasket combination as found between power shaft rear bearing housing and H599R cover. Begin final assembly using the SAME thickness (dry, no gasket sealer until all adjustments are done), and mount power shaft assembly into H599R cover! Install a total of four guide pins; upper-left and lower-right (pilot holes), then at (say) 2:30 o'clock and 7:30 o'clock. On the guide pins, dry-hang the gasket between main case and H599R cover. Carefully install power shaft/cover assembly with guide pins to control a "straight-in" insertion of the gear-end bearing into its bearing boss of the main case. Finally, in the four remaining cover holes, install and tighten 3/8 x 1-1/4" cap screws.

WARNING! -- During tightening of the rear cover screws, periodically hand-test power shaft for free rotation. **Gears must rotate freely when power shaft is turned by hand**. Binding is a sign of "zero backlash".

No Prior Data Gathered -- In event you have no prior thickness data for this shim-gasket thickness, I recommend you begin with an arbitrary thickness of **0.100 inch** (1/10th inch) and work back from there.

OBSERVATION: Note that there is very little space between the power shaft end and the AH1224R or H789R driving collar. See earlier discussion, "PTO Jumps Out of Gear". Shim thickness has a direct impact the amount of space that exists at this point.

Gear Backlash and Heel (Preliminary) -- When it comes to gear backlash settings involving gear pairs over 60 years in service, it is far more prudent to have “some" than to measure between 0.006 and 0.010 inch! Too little backlash will often result in cracked gear teeth and an eventual need to renew gears that otherwise would have provided years of good service. At this age of the JD "H" Tractor, the most successful criteria here, for backlash, is that you have some! I am not a great fan of installing these old gears too tightly together. I suggest using the criteria as set forth in FSB 96-S (4-15-39); "Gears should mesh so there is a slight amount of backlash and rotate freely when the power shaft is turned by hand".

Gear Heel -- Ensure bevel gear heel-to-heel alignment (heeling) by adjusting the quantity of shims between power shaft bearing housing and H599R cover.

Backlash Adjustment -- Backlash is adjusted by moving the sliding shaft left or right, which (in turn) is by adding shim thickness on one end and decreasing it on the other. Test for power shaft backlash and freedom of rotation. Adjust shim thickness at the ends of the sliding shaft until the driving gear engages the driven gear so there is a **slight amount of backlash (readily discernable)** and **gears rotate freely when the power shaft is turned by hand.** (FSB 96-S, 4-15-39). The shaft must be free to rotate without binding to indicate there is no "hard interference" between the gears.

Disassembly of Rear Axle Housing Assembly (PC304, page 27)

Preliminary -- Take close-up picture of each end. Observe that Bearing Cup (28), Retainer (29), and Oil Seal (30) remain in the main case. Note that there most likely were no Differential Spacing Washers (27), but if there were, tag-identify them and **journal** how many there. This data will be useful when reinstalling rear axle assemblies. See differential assembly (end play) adjustment.

If brake adjustment screw (19) is not frozen in position, back it out several turns to relieve tension of brake shoes against brake drum, this to reduce possibility of damage to brake shoes when pulling drum.

Inner end -- Remove differential spacing washer(s) (27 - if there are any), H443R spacer (26) JD 7395R bearing (25), and the H442R spacer (24). **Journal** the direction or orientation of H442R spacer bevel. The bevel edge must face **TOWARD** the bearing (25) during reassembly. The Service Bulletin of May 15, 1939 "Rear axle assembly on model "H" tractors" is incorrect as relates to orienting the H442R spacer.

Order of Removal -- String safety wire through all removed components to maintain their order of removal, and store in a box -- use separate box for each side's parts.

Pulling Brake Drum -- Pull brake drum (23) using a suitable puller. Presoak beforehand as required. Use common sense. A several-day presoak is far better than a drum bent up during the pull. Be sure to use a tool that has a FULL bite on the drum's pulling interface; again, to make the pull without distorting the drum. Finally, this is NO PLACE for a hammer! Brake parts are expensive. Treat them as high-value items. Use lots of penetrating fluids. Use heat as a final resort.

From DIR276 -- Brake drum can be removed by placing the heads of two (squared-headed) bolts through the square openings in the drum, sliding the bolt in slots provided and then pulling drum off by putting a clamp bar over the end of the rear axle shaft and tightening the nuts on bolts.
`

TIP: **Brake Drum Reference Snap Ring --** Remove H441R brake drum reference snap ring (38). See figure 415, over toward the right side end. The I&T Shop Service Manual fails you here. You must remove this snap ring before withdrawing the axle to prevent damage to H430R retainer (11). Be advised this retainer is no longer available from Deere.

Figure 415. Rear Axle. Bearing stop on left and brake drum reference snap ring on right

Outer end -- Remove three cap screws (1), dust excluder (3), bearing cover (4) and shims (5). Bind together to preserve their order of removal, and store in left box or right. Keep left and right separated, and distinguished.

Withdraw -- Axle shaft from outer end of housing, the shaft and remaining parts (6 thru 10). Remove these parts from the shaft and wire them together to preserve their order of removal; store along with parts removed. Observe that the inner felt washer (12) and its retainer (11) remained behind in the casting. Also left behind are the components of the braking system minus the drum.

Figure 416 (A&B). A - Excessive Use of Force, and B - Defective Parts Found

Figure 416 -- The result of excessive force (using hammers) to remove the pedal shaft is shown in the illustration on the left. Allowing brake shoe to turn upward rather than drawing it straight back caused an ear to break off the adjusting pin. Two unserviceable parts are shown on the right. The shoe came out

with an ear missing where it interfaces the adjusting pin, and the brake spring should not be stretched as this one is. All these parts are now worthless!

Brake Disassembly -- Remove brake shoes, springs, cam, adjust screw, and adjusting pins (19, 20, 31, 32, 33), store. Use caution to avoid damaging the adjusting pins. Draw shoes (31) straight back in order to disengage from the adjusting pins (20) An upward motion can break an ear off rendering the adjusting pin useless.

Figure 417 (A&B).

Figure 417 -- While this may not be a sophisticated solution for removing a brake pedal shaft, the concept is sound, and it works! It avoids the need and temptation to use brute force. No damaged parts!

Brake Pedal Removal -- Remove brake pedal (16) from pedal shaft (39) and withdraw pedal shaft from casting. Store pedal shaft with other brake parts. KEEP LEFT and RIGHT PEDAL SHAFTS in LEFT (flywheel-side) and RIGHT (pulley-side) boxes. Removal of the pedal and pedal shaft is often easier said than done! Presoak the pedal-pedal shaft joint. Heat may also come in handy. If the pedal shaft is stuck in the casting, rig up a press using a hydraulic jack and some ingenuity as shown in Figure 417. If other smaller brake parts are hung up in the casting, hire a machinist to have them removed. This will save costs in damaged brake parts and/or a cracked casting.

Remove H429R inner felt washer (12) and its H430R retainer (11) using a suitable bar, driving from the flared end of the casting. Straighten and store H430R retainer for reuse.

Brakes and Linings-- At this stage all effort turns to renewal of the brakes, and of the places where the axle housing casting and braking system meet, along with a total cleaning in preparation for remaining phases of restoration. Inspect shoes for structural damage and general worthiness, and be prepared to install new linings. Closely inspect the end of the shoes where the cam rollers mount. Repair elongated or enlarged holes. Roller pins should fit but have no more play than that of a bushing (0.002 to 0.004 inch clearance). Clean and inspect brake drums and prepare for turning as required. Procure replacements for unserviceable shoes and/or drums. Then have them reconditioned by a pro. Attaching new linings

onto brake shoes is no trivial matter. The tooling to do the job yourself and do it right are cost prohibitive. Instead, purchase new shoe linings from Deere or an after-market supplier. Commercial shoe linings are too hard for the JD-H. Then take brake shoes, new linings and drums straight to a "Clutch and Brake" repair facility along with a simple statement of work. Your local auto parts supplier may have the capability to bond those new linings to your brake shoes! This may be a job best left to a professional. Both shoes and drums will be returned to you - ready to install. Do this early-on so they are ready and waiting for you when build-up time comes. **See SOW**, Brake Shoes and Drums, chapter's end.

Criteria -- After a thorough cleaning, inspect the interface between brake cams and the shoe rollers for wear, always looking for a means to reverse it. New brake shoe roller pins are usually a wise alternative. Pin length is significant when buying replacements. Those washers are special -- protect them, and if they aren't reusable, seek good used ones. Check the two cams for breakage, for really deep pitting, and for heavy wear at the roller interface. Reject any part that could possibly result in the roller pairs jumping off the cam during operation. Closely examine the adjusting pins -- broken-off ears and severe pitting are grounds for renewal. Look for parts such as a spring that is either broken, or distorted in some way (bent or stretched). Make individual "reuse or replace" decisions -- record in your **journal** and in your **procurement log**. For parts that cannot be repaired, replacement is the only option. Bear in mind that the brakes are perhaps the most-used parts of your tractor. While their design may be marginal, to operate your tractor safely, they must work!

Pedal Shafts -- This is such a major item in a 60-year old tractor that it was left to last to discuss. Once shoes, drums and linings have been dealt with, and all of the small brake parts examined, and reuse decisions made, the main interface between the brake and the axle housing needs a very close look. Using solvents and wire brushes, do a super cleaning job on the pedal shaft and also the splines in the pedal. Be particularly diligent in cleaning the casting bore the pedal shaft fits into. Here's the procedure: after removing all the accumulated debris, reinstall pedal shaft and pedal with its washer and nut, left pedal shaft to left casting, and right pedal shaft to right casting -- and test for looseness, both wobble and shaft end-play.

Brake Pedal Wobble -- The pedals shouldn't have sideways play or wobble. Sideways play in a brake pedal will usually indicate the need for buildup and turndown of brake pedal shafts, and perhaps even new bushing activity in the housing containing such shaft, or a combination of actions. If the shaft is to be built up and milled to fit a honed bore, the build-up cannot extend toward the threaded end into the normal splined region of A152R pedal shaft. If it does, the brake pedal will not draw up onto the pedal shaft during assembly, and the shaft needs further rework. What dimension is to be strived for? The machinist's dimension for standard bushings applies here. The machinist will generally seek a "snug fit". Discuss this when you bring him your statement of work and, annotate the agreed upon clearance. One fact to bear in mind here is that the machining result may indeed result in "matching" each pedal shaft to a particular casting. For a given side, both casting and shaft are to be taken to the same machinist as a unit. **See SOW**, A152R Pedal Shaft Machining at chapter's end.

Pedal Shaft End-Play -- Pedal shaft end-play must be limited to reduce possibility of brake shoes "jumping track" off the brake cam. This end-play is a result of wear under the head of the bolt-like shaft, and is reduced using shim bushings (shim washers). To take up the end-play, use one or two 7/8 x 1-3/8 inch shim washers inside the housing, placed under the cam holder part of the pedal shaft. If a third is needed, place it just outside the housing (between housing and pedal). Use a trial and error process to get the right shimming. This determination can be pre-made or done during brake assembly. The criteria here is that brake pedal action is free once the brake pedal is drawn up fully onto the pedal shaft, and pedal shaft end-play is not more than the thinnest shim-width. These shims, sometimes called "machinery bushings" are available from fastener stores in varying thicknesses of 3/64 inch and up.

Main Case Rear Axle Seals -- In any brake job, whether as part of restoration, or because the brakes have failed, the occasion of having the axles out of the tractor is an excellent time to renew the two AH633R (Victor 49501) seals. Failure of these seals ruins most brake systems on the JD "H" tractor. See **Removal and Replacement of Inner Seals**, earlier in this chapter.

Weep holes -- This is your second line of defense for those new brakes. There is a 1/4 inch diameter "weep hole" at the very bottom of each rear axle housing, directly under the brake drum, actually in the mounting flange of the rear axle casting. This hole allows both oil and condensation to depart from the axle cavity rather than accumulate and ruin the brakes. MAKE SURE THESE ARE OPEN! Check them at every oil change, and at least once every year otherwise.

NOTE: If oil is oozing from a weep hole, it is time to renew the AH633R inner seals. Then when reinstalling the rear axle assemblies, be sure to perform bearing preload to prevent the axle movement that caused seal leaks in the first place. Lacking bearing preload is sure to result in damage to seals, oil leakage and repeated failure. A visual check for oil should be made at the weep holes at every engine oil change. Any oil in the housing can find its way onto brake pads and adversely affect brake performance.

Rear Axle Housing -- Build Up

Preparation -- Pre-treat felt washers (H423R and H429R) with engine oil prior to installation into this assembly. Add drops of oil and massage in much like you would for an air filter of a lawn mower engine. You want lots of oil in the felt, but not so much that it drips! Too much oil will result in oil oozing out and dripping from the rear axle for a long time. Clean and pack JD8102R roller bearing. Have brake shoes with new linings and drums turned if needed, and all brake parts available and serviceable. Finally, make copies of this procedure to be used as a checklist, one for each axle housing assembly.

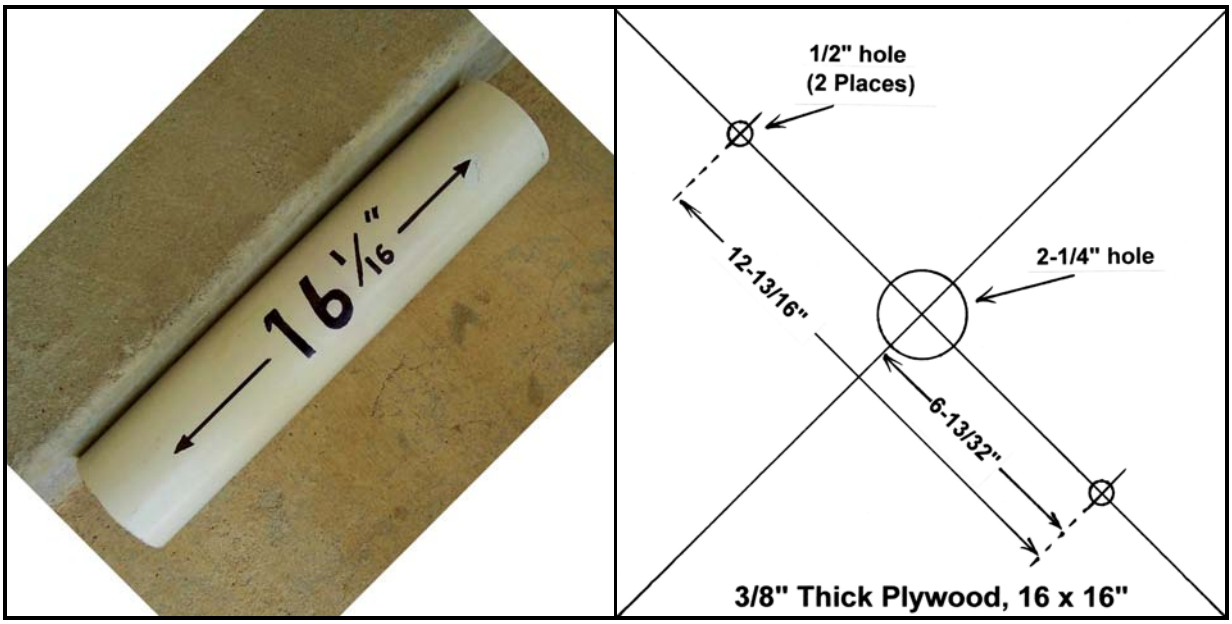


Figure 418 (A&B).

Special tooling -- Figure 418 -- Procure a short length of 3-inch schedule 40 PVC pipe that is between 16-1/16 and 16-1/8 inches long, called a Tooling Sleeve (Figure 418A). Prepare axle centering template from a 16 x 16 inch piece of 3/8-inch thick plywood, with holes bored per Figure 418B.

Remove old felt washer and its retainer, and install brake latch -- Position housing with flange to the side. Using an awl or other sharp instrument, first remove the old felt washer. Then, use a suitable tool

to drive the retainer out of the housing casting. Removing this retainer is a challenge best overcome by patience and some wise choices in advanced lubrication and tool selection. **Be careful** with it because it must be reused. Straighten as required. Install H435R pedal latch. Orient latch as shown in Figure 419A.

Install pedal shaft and brake pedal -- Verify cam position to be at 30 degrees in relation to drum surface when pedal is up, and almost parallel with drum surface when pedal is down. See figure 419B for cam position when the pedal is up. Verify that pedal shaft end-play is not more than 0.048 inches (shim thickness). See shim bushings discussed under "Pedal Shaft End Play".

Weephole -- Verify casting drain passage is free and clear (See prior section).

Install Seal and Retainer -- Reposition housing with flange down. Install oil-treated H429R felt washer into housing, followed by H430R retainer. Firmly but gently drive retainer fully into casting.

Install brake parts, and then axle centering template -- Reposition housing with flange up. Apply a liberal coating of an anti-seize compound to the surface of the cam, adjusting pins, pedal shaft; and to the bores that each of these fit into. "Nev-R-Seez" by Permatex is highly recommended. Choose a silicon based product with main additives of graphite powder, or aluminum or copper flakes to give better performance over time. Also apply anti-seize to both mating thread sets for the adjusting screw, and to this screw's fluted tip. Install brake shoes w/springs, cam, adjusting pins; and set adjusting screw for minimum expansion of the brake shoes. Verify the pedal shaft is in the right position, then ensure the pedal retaining nut on pedal shaft is tight. See Figure 419B. Install axle centering template shown in Figure 420 over shoes and across casting flanged end. The template is designed to center axle shaft when it is inserted. The hole in the center is for axle shaft to protect the axle seal and retainer just installed.

Install Axle, and Outer Bearing Group -- Place a small shop floor mat (or carpet sample) down, and then two stacks of three short pieces of 2 x 4 blocks as illustrated in Figure 420A. Place the casting, flange down, with template installed onto the stacks. Verify stability. This combination is designed such that the axle shaft may extend downward some **5-1/16 to 5-1/8 inches** lower than the housing when in the **flange-down position**.

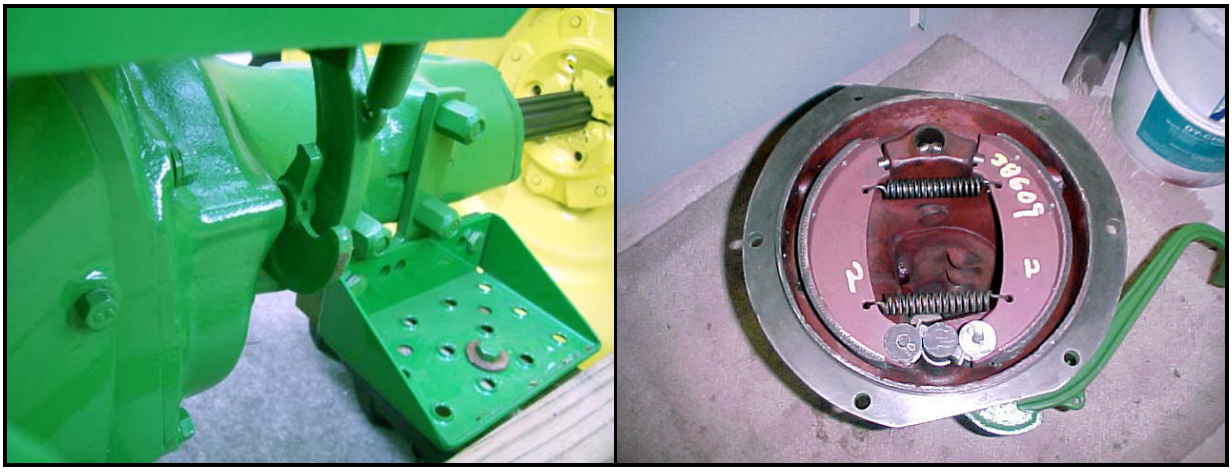


Figure 419 (A&B).

Figure 419 -- At left see orientation of H435R brake latch. At right, see brake parts just installed into a "ready" housing. Note pedal cam inserted into pedal shaft at bottom and adjusting devices at the top of the right illustration.

Figure 420 (A&B).

Figure 420 -- Illustrated on right is axle centering template installed. At left is Housing with template installed, mounted atop two stacks of three 2 x 4 blocks. Axle and Bearing group is already in place in this photo.

Insert axle shaft, being careful not to damage either the H429R felt washer or its H430R retainer. Verify that the shaft's **bearing stop** is about to encounter the H430R retainer, but not resting against it.

Slide the H422R bearing spacer, then the **packed JD8102R roller bearing** onto the axle; followed by the JD7425R bearing cup. Seat such that H422R spacer is snug against the bearing stop.

Install H423R oil-treated **felt washer** onto H631R Retainer (Flange end of retainer into felt washer), then insert H631R Retainer w/felt washer into 425R bearing cover. Then insert these two into H425R Bearing Cover. Combine with shims as a group, and -- grasping all these squarely, slide down the axle shaft until either snug against the bearing, or snug up to the housing. (H424R Dust Excluder is not installed at this time). Install 7/16 x 1-1/2 inch cap screws. Tighten to snug only.

Install Brake Snap Ring, Drum, and Inner Bearing Group:

Preparation -- Slip PVC Tooling sleeve (Figure 418A) over external end of axle. The tooling sleeve will support weight of the casting unit as it is again inverted, now positioned flange up. Again, place suitable cushion material on shop floor to ensure no physical and cosmetic damage to axle's end. Stabilize in vertical position, and remove centering template. The sleeve is carrying the casting weight, so the axle isn't pressed upward into the casting, thus preventing the axle bearing stop from distorting the outer oil seal retainer.

SUMMARY NOTE: At this stage, the axle shaft is prevented from outward travel by the H425R bearing cover, and prevented from inward travel by the tooling sleeve.

OBSERVATION: The dust excluder (H424R) is not installed until later; right after bearing loading adjustments are completed during final assembly and integration. It just gets in the way.

Procedure -- Install H441R snap ring, and then brake drum; drum goes up against the snap ring (it is the brake drum reference). Find H442R spacer -- the big one. Apply a coat of shellac (Indian Head Shellac or

No. 3 sealer, both by Permatex) to its inner surface; then, slide it onto the axle shaft, snug up to the drum. Beveled side of this spacer is **AWAY** from drum. FSB 97-S (May 15, 1939) -- Rear axle assembly on model "H" tractors is incorrect as relates to orienting the H442R spacer. Install JD7395R bearing, larger end toward drum, onto axle shaft, snug up against H442R spacer [Note this bearing is not packed with grease. It receives its lube from differential case, and is just lightly oiled to prevent corrosion]. Finally, install H433R bearing spacer (smaller one), snug up against bearing.

The Rear Axle Housing Assembly is now ready for installation onto the tractor's main case.

Repeat the build-up series of steps above for the other axle housing assembly.

Final Drive Integration

Mount axle assemblies to the tractor -- Set differential assembly into main case. Block this unit up so that its side gears are close to being in line up with axle shaft path. With a helper, or with an overhead hoist, mount rear axle assembly to tractor, carefully inserting axle shaft into the differential side gear. Best practice is to be perfectly in line with differential -- this alignment has least potential to damage those new rear inner seals!

a. Install 1/2 x 1-1/2 inch cap screws; but before drawing them up snugly, back each of the three 7/16" cap screws securing the outer bearing housing to the axle by roughly 1/4-inch. (See Figure 421), and then tighten the 1/2" cap screws, drawing them up snugly.

b. Review the **WARNING** note No. 2 under Figure 410.

c. Carefully "snug" up the three 7/16" cap screws achieving EQUAL tension on each and EVEN gap all around. Now systematically close the gap by tightening each of the 7/16" cap screws 1/2 turn at a time. As the separation is getting smaller, all bearings, bearing cups and spacers are being fully seated. Be very careful, very sensitive to the amount of torque required as you go around making the 1/2-turn operations so that you know when the limit is reached! At this point, remove the 7/16" cap screws and install shims to close the remainder of the gap. When the cap screws are tight, you should be able to grasp the axle shaft and turn it! If you cannot turn it, keep adding shims until it can be turned when the cap screws are tightened. This adjustment will be finalized during bearing load.

Repeat the steps above for the other axle assembly.

Figure 421. A Safety Feature!

Perform Bearing Load Adjustment (DIR276 and May 15, 1939 Service Bulletin) -- The rear axles are carried on tapered roller bearings that should be checked and kept adjusted. Tractor is jacked up and rear wheel is not mounted.

1. Remove dust excluder (if installed), outer bearing cover and felt washer. Set felt washer aside. Next, loosen all except the top cap screw holding the rear axle housing to case until only a very slight tension is exerted by the lock washers.

2. Replace outer bearing cover and shims, draw up cap screws evenly until outer bearing cover is tight.

Two outcomes here -- Axle housing pulls away from case at bottom, or axle housing DOES NOT pull away from case at the bottom. Read carefully:

3. If rear axle housing pulls away from transmission case at the bottom, add one 0.005 inch shim (PC304, page 27, item 5) at a time until housing does not pull away from case. (Note: Bottom cap screw in rear axle housing must be drawn up snug each time bearing cover is removed to add a shim.) Criteria here is that when loosening the bottom cap screw, the axle housing DOES NOT pull away from the case. And at that point, skip step (4) below.

4. If axle housing DOES NOT pull away from case, remove one 0.005" shim at a time until it DOES pull away. Then return to step (3) above.

Replace outer bearing felt and dust excluder and tighten all cap screws.

Repeat steps (1) thru (4) above for the other axle bearing.

WARNING -- Perform Bearing Load Adjustment BEFORE Differential End Play Adjustment!
Performing differential end play adjustment prior to bearing load adjustment will adversely affect the outcome of bearing load. Bearing load must be accomplished when axle is free to travel.

Differential Assembly Adjustment -- *When reinstalling rear axle housing* to the main case, it is important to provide sufficient shims between the bevel gear and H443R bearing spacer to establish a fixed amount of differential assembly end play. See PC304, page 27-27. Adjustment is made by means of steel shims, JD part number 24H79R (now 24H1569, App 16) on either side of the differential assembly, and is performed BEFORE bearing loading (below). End play shall not exceed the thickness of one shim (1/32-inch). These shims provide specific engagement of the differential bevel gears, and failure to set the amount of end play will result in uneven wear and premature failure of the bevel gears. Reference is DIR 214, DIR 248, and DIR 276.

Install both axles, measure the "free space", remove an axle, and install sufficient shims to "fill the void". Re-measure to be sure end play is less than or equal to the thickness of one shim.

Sources of suitable shims include those who sell used parts, and industrial fastener stores. The inside diameter (ID) of these shim washers (called machinery bushings by some) is 1.75 inches. Shims available from industrial fastener stores may not be less than 3/64 inch (roughly 0.047-inch). The OD can be fairly large which broadens your choice range.

Rear wheels may be installed, and temporary blocking removed from beneath differential assembly.

Closure of Transmission and Differential Cavity

Once the transmission, both rear axle housing assemblies, and differential are fully installed & adjusted; and all testing is complete to include engagement of the PTO drive collar with the driving gear, the top and rear covers of the transmission-differential cavity are all that remain to be installed.

Top Transmission Cover -- Before installing, make a final check of the three adjustments just visited. It is far better now than later to have to "go back in". Align sliding gears. Move shifter shaft to right or left until the second speed gears have full tooth width contact when the gear shifter detent is in the proper notch. Tighten locking cap screw in shifter shaft adjusting screw and set screw with lock nut (FSB 96-S, 4-15-39). Treat gasket with a soft sealer similar to Permatex 3 Aircraft Form-a-Gasket compound. When installing the cover, do your best to get a feel for the engagement of the drive collar into the PTO drive bevel gear. If needed, use a drill bit to "enhance" the detent seats under the PTO shifter lever. Also inspect the shifting components of the power shaft system.

Rear Transmission Cover (Tractor with PTO) -- Locate and install four guide pins (bolts with head removed), hand-tight, into the four "**select**" positions in the main case casting. Separate power shaft and H599R cover sufficiently to enable application of a soft gasket sealer, then retighten and clean away excess gasket cement. Apply gasket sealer to H599R cover gasket (both sides) and "hang gasket on the four guide bolts. Carefully bring power shaft/cover assembly into position (watching guide pin engagement) and slide forward installing cover. After installing four of the cap screws, remove guide pins and install remaining cap screws. Use limited torque on the cap screws (not more than 20 ft-lbs), drawing up rather evenly to avoid hurting the cover.

Rear Transmission Cover (Tractor without PTO) -- This is a very simple job indeed.

(1) Ensure your H327R rear cover is true or flat -- use kitchen table or a countertop to test it. Straighten as required. Install your guide studs, treat the gasket with a soft gasket sealer and install cover.

(2) After installing four 3/4-inch-long cap screws with lock washers, remove guide pins and install remaining cap screws.

(3) When installing the H327R pressed steel cover, use very modest torque on the cap screws -- just enough to compress lock washers. This is only a small amount beyond hand-tight! Treat tightening of covers made of pressed (a stamping of) steel like you would a valve cover on a '57 Chevy.

(4) Allow installation of rear covers to stand overnight before adding gear lube, and do not re-torque the cap screws the next day! ++++

Wisdom Calls

Psalm 1 -- Oh, the joys of those who do not follow evil men's advice, who do not hang around with sinners, scoffing at the things of God. But they delight in doing everything God wants them to, and day and night are always meditating on his laws and thinking about ways to follow him more closely. They are like trees along a riverbank bearing luscious fruit each season without fail. Their leaves shall never wither, and all they do shall prosper.

But for sinners, what a different story! They blow away like chaff before the wind. They are not safe on Judgment Day; they shall not stand among the godly. For the Lord watches over all the plans and paths of godly men, but the paths of the godless lead to doom. (TLB) ++++

Statement of Work [Example]

(A152R Pedal Shaft Machining)

Problem -- Too much play (wobble) in both brake pedals.

Criteria -- The A152R Pedal Shaft pieces were initially designed with OD of 0.8750 inch to fit snuggly into the H418R/H419R Rear Axle Housing castings with only the "operational clearance" needed to avoid binding. This operational clearance was in the neighborhood of 0.003 +/- 0.001 inch in the OD of the shaft and the ID of the bore in the casting, a "snug fit".

Machine Work to be Done -- The pedal shaft must now be built up and then milled to a dimension that will eliminate the "wobble". Both of the pedal shafts and both rear axle castings must be taken to the machinist so the amount of build up needed for each can be individually determined. In the end, it may very well be that each pedal shaft is uniquely fitted to a particular casting, and if this is the case, make notes for reference through final assembly.

Additional Hardware (end-play):
Two elements come into play here: (1) contamination or corrosion preventing A152R Pedal Shaft from fully engaging the H436R/H437R Brake Pedal and (2), wear over time at the head end of A152R Pedal Shaft.

Items to be delivered to Machinist:
Two (2) A152R Pedal Shafts
Two (2) Rear Axle Housing Castings

Statement of Work [Example]

(Brake Shoes and Pulley Brake)

Problem: Brake linings no longer serviceable, and brake drums need to be 'turned'. Pulley brake lining worn to its limit of use.

Scope:

Four brake shoes (Customer furnished)
Two brake drums (Customer furnished)
One special pulley brake arm (Customer furnished)
Four Brake linings (Customer furnished)

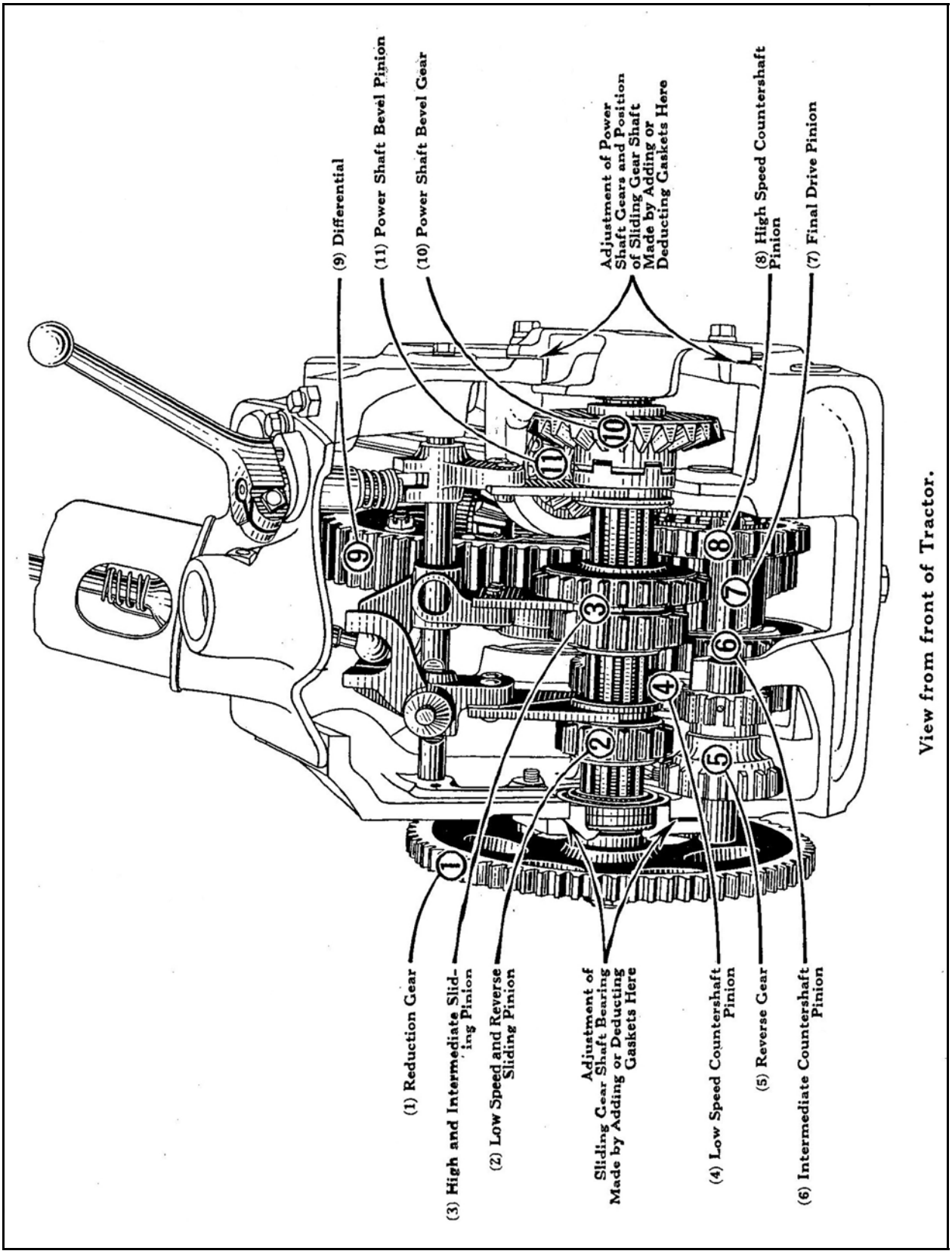
Work to be Done:

1. Clean and reline the four brake shoes. Method of bonding is expected to be rivets as originally used, or a technology that is superior to rivets so long as it is not more expensive.
2. Turn the two brake drums to achieve an "industry-accepted" braking surface. See certificate below.
3. Remove old lining (left on to illustrate construction), then apply new lining to special pulley brake arm.

Return to Customer:

Please return finished products (all seven pieces) to John Q. Public, Sr., 123 Elderberry Street, New Castle TX 78332, by either UPS or FedEx.

Certificate -- I, John Q. Public, Sr., per shipping address above do hereby certify that all these equipment items are part of one 1942 John Deere Model "H" farm Tractor, S/N 42820; and that as such, shall not ever be used for any over-the-road activity on US or Interstate highways. (Client Signature would follow).


(9) Differential
(11) Power Shaft Bevel Pinion
(10) Power Shaft Bevel Gear
Adjustment of Power Shaft Gears and Position of Sliding Gear Shaft Made by Adding or Deducting Gaskets Here
(8) High Speed Countershaft Pinion
(7) Final Drive Pinion
(1) Reduction Gear
(3) High and Intermediate Sliding Pinion
(2) Low Speed and Reverse Sliding Pinion
Adjustment of Sliding Gear Shaft Bearing Made by Adding or Deducting Gaskets Here
(4) Low Speed Countershaft Pinion
(5) Reverse Gear
(6) Intermediate Countershaft Pinion
View from front of Tractor.

Excerpt from FSB 99-S, 15/July/1939, JD-H Transmission

Steering and Front Ends

Chapter 5

General -- The steering system always demands some attention. Like shifters and brakes, it is essential to the tractor's operability, and gets a lot of wear. While most of the mechanical engineering for vintage farm tractors was very good, not so in steering where areas of weakness abound. Steering system corrective action can also be both extensive and expensive. Basic criteria outlined in your service manual plays the dominant role here.

TIP: **Thrust Bearing --** Do not overlook inspecting and repacking the lower thrust bearing. It carries the entire weight of the tractor's front! When the thrust bearing is reinstalled, be sure the bearing is oriented correctly (See figure 501). You can physically install the bearing upside-down. There is only one correct way! Looking at the inner ring, the side with the most prominent inner ring is the wheel side, down! The side with the most prominent outer ring is the pedestal side, up! These prominent rings are the weight bearers. If the bearing carries a "THRUST" mark, install the bearing with **the side marked "THRUST" facing down**.

TIP -- **Removal of Pedestal Thrust Bearing** -- If the old bearing comes out in pieces leaving only the bearing race behind and there doesn't seem to be enough space for a puller, carefully run a bead of weld around the surface of the bearing race and when it cools, it will fall out. **CAUTION** -- Make sure the weld stays on the bearing race. If you run off track you have just welded it fast!

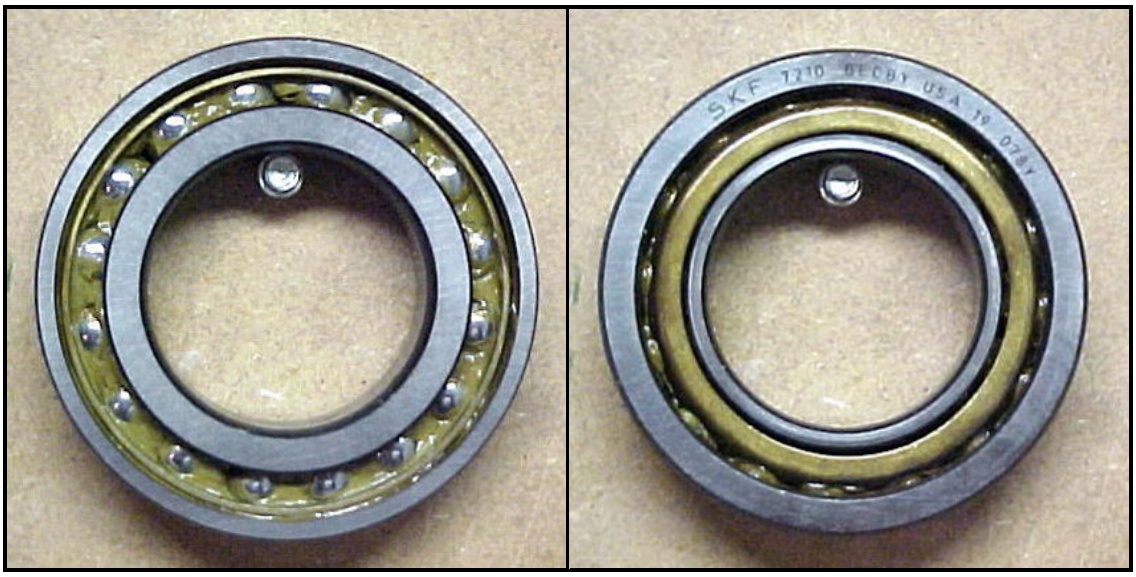


Figure 501. Thrust bearing. Prominent inner ring (left), and outer ring (right)

The Steering Wheel -- The steering wheel covering of most the older tractors will have some voids. If the wheel isn't totally void of the black hardened rubber material, one method of repair is to make repetitive applications of BONDO ™ or JB Weld ™ to fill voids and cracks, and to restore missing sections of the basic construction. This work is followed by body creams and finishing primers and light sanding to close remaining age cracks and to reestablish grip contours. The resultant grip portion is then painted using RUST-OLEUM™ Gloss Black; the hub and spokes painted the usual Classic John Deere Green. When applying final coatings, the green part is done first, then masked off for the black painting. RUST-OLEUM ™ takes at least one full month to fully cure, so plan accordingly.

Figure 502. Steering wheel repair. Bondo ™, basic filling, finished (right)

Aerosol Plasti-Dip -- Plasti-Dip (a type of rubber/plastic coating) has been around for a long time as an insulating medium for electrical tools. Dip the handles and presto! They were insulator-coated. The trick here was the item being coated had to be dipped! Now we have an aerosol version that seems to hold lots of promise for coating a repaired steering wheel. The routine is to repair voids in the handgrip part of the wheel with hardening fillers like BONDO™ or JB Weld™ and prepare the entire wheel for paint. Then paint to final the center with JD Green. When it's cured, mask the spokes and center piece; then install a 3-ft section of all-thread with a pair of nuts and flat washers. Prepare a suitable stand down into which to insert the rod ends. You now have the means to apply the aerosol Plasti-Dip with one hand while manipulating the wheel with the other. Work one side and then the other, two or three coats. The result was very good, and for much less cost than having my wheel refurbished. It works! I purchased from www.caswellplating.com; this product is now available at Home Depot home improvement stores.

Figure 503 (A&B). Basic Repair and Green paint on left, and tooling set up on the right.

Figure 504 (A&B). Initial Coating of Plasti-Dip on left, Final Coats Illustrated on the right.

Basic Criteria -- Look for steering (worm) shaft end-play, detectable at the bearing near the throttle handle, and also the amount of free rotation (backlash) of the steering wheel before the front begins to turn. As you open the front mechanics to further inspection, you will get closer to root causes of anomalies noted, and then be in a position to begin selecting remedies. The objective in the restoration process is to "reverse the years of wear". Shafts have to be built up and then turned down to the stated dimension. Bushings often have to be installed, and then honed to fit. Some redesign isn't beyond the pale here either. The upper steering bushing (near throttle) is prone to wear. Rather than run it dry, one may choose to install a grease fitting into the bearing/bushing combination after renewal. See Appendix 7 for complete listing of acceptance inspection criteria for bearings and gears.

You may find some areas of non-compliance that are not practical to deal with 100%. One example is a worn but still useable steering worm gear. The only known source for relief for this item is to find one from a tractor graveyard that is better than yours! You can renew the mating sector gear and obtain some relief. The real issue may be how smooth the teeth on the worn worm gear are. If the worm is super rough or heavily abrasive, your new sector gear may be in for a short life! It's a judgment call.

Variables in Loose Steering -- for the "H" Tractor -- PC304, page 31/Figure 507 -- Lack of maintenance & adjustment should be considered first (Section 9). Thereafter, the list of contributors are the 19H89R Lock Screw (20), worn spindle shaft (where it rotates in the eccentric bushing), the H200R Sector Gear (40), the H197R Eccentric Bushing (21), the worm-gear on the end of the steering shaft, and finally the H270R + gaskets (4), the quantity & thickness to be determined during the worm shaft end-play adjustment.

Lock Screw -- Over time, the 19H98R Lock Screw is prone to loosen. No lock washer is used here. Periodic maintenance should catch looseness, and result in correction. When loosened, the H197R Eccentric Bushing is permitted to rotate back and forth as the tractor is steered to the left and/or to the right. Several unintended wear points result: (1) the 5/16-18 tapped threads in the pedestal casting wear/erode, (2) as the eccentric bushing rotates to and fro, wear takes place to reduce the bushing's OD and the pedestal casting's ID at the interface of these two parts, and (3) the lock screw itself is worn losing diameter, thus allowing even greater 'to and fro' motion of the bushing.

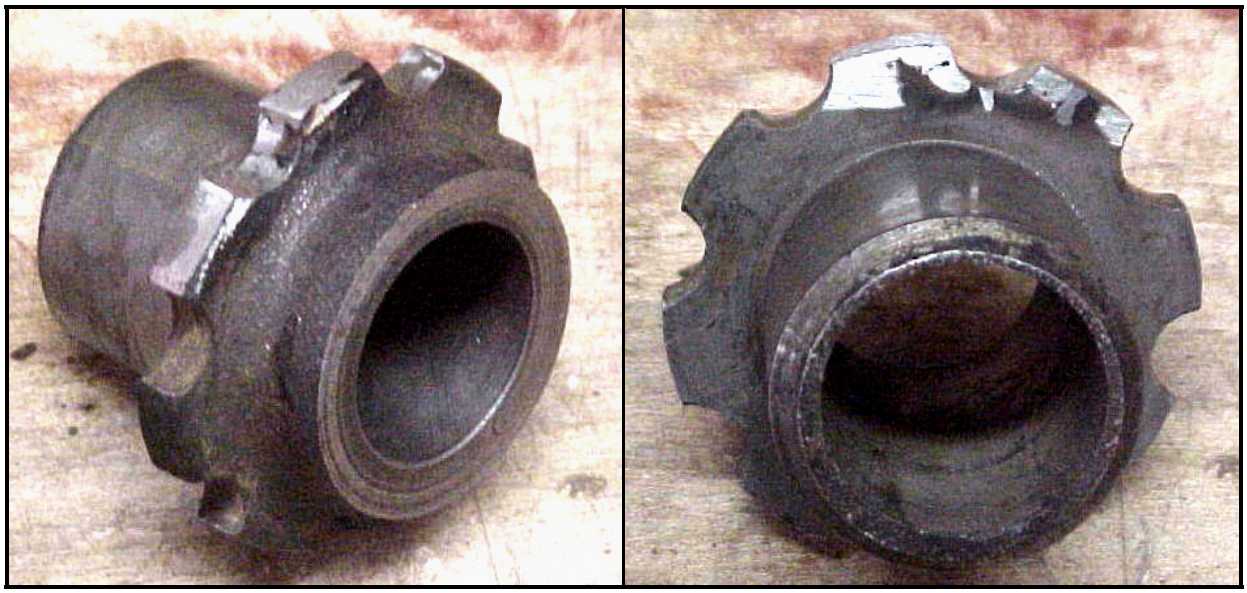


Figure 505. Repairs made to Lock Screw interface parts of the eccentric bushing

Excessive wear of the spindle shaft is a direct result of a "dry interface". Poor preventive maintenance to include periodic lubrication for steering components is very common.

Sector Gear -- The H200R/H1026R sector gear is of marginal design to begin with. The most common faults are worn teeth that resulted from (1) lack of lubrication (poor maintenance), and (2) out of tolerance backlash adjustment (too little engagement of its teeth with worm shaft gear). A less common fault is lack of a tight connection between the spindle shaft and the gear. This can be a result of incorrect spindle end-play adjustment, or failure during installation to fully tighten its retaining nut. Or perhaps the cotter pin was not installed. See Figure 506 and comments below it.

Figure 506 (A & B).

Figure 506. On the left is a new sector gear compared with worn gear in the center. On the far right, is a sector gear that no longer grips the spindle shaft. Retaining nut is full down and yet, an index card can be slipped between washer and the gear. Renew gear or shim the interface.

Renewal of B3310R Washer -- Renew the B3310R washer when overhauling the series H steering gear unit. Draw the nut tight enough so as to smash it into the recess provided. If this is not done, after a short period of operation, the washer sinks into the recess allowing the steering shaft to loosen as shown in Fig. 506B (Field Service Bulletin 158-S, 9/15/1947).

Worm Gear -- The final variable in this series is the AH578R/AH1078R steering shaft & worm gear. Your hope is that by curing other ills, performance standards can be met by making the prescribed steering adjustments. If so, you will be able to find the worm gear serviceable.

CAUTION! -- Be aware that with the beginning of 1945 production (H47796-up), both the sector gear and the steering shaft & worm gear changed. So in procurement, you must obtain a suitable replacement for either the sector gear or the shaft assembly.

Corrective Actions -- Wear has to be reversed or eliminated in the "loose steering" equation! By definition, to restore is to reverse wear and tear. The test is for steering elements to meet service manual performance criteria.

Search for NOS (New Old Stock) parts, and/or choose to fall back on serviceable used parts. This is the objective in relation to a bad lock screw, sector gear, eccentric bushing, or even a badly worn worm shaft gear. Begin with your local JD Dealer. Check Appendix 3, Vendor List. Then, search using restoration enthusiast magazines such as Two Cylinder or Green Magazine, and the Internet. Be aware that the cost of NOS parts is often substantial. Don't panic when discussing price and availability; seek to call back later if you need time to think about it. You may not have an alternative!

A good machine shop is almost certain to play a role, as in the following suggestions:

(a) Where that 5/16-18 tapped hole has been worn excessively (lock screw into pedestal casting), overbore and install a 5-/16x18 helicoil that is ½ inch deep to receive a replacement 19H98R Lock Screw.

See Pedestal Casting -- Inspection and Renewal, Section 2.

(b) For machining activity to restore the steering shaft interface at the rear bearing, see **Steering (worm) Shaft -- Inspection and Renewal**, Section 2.

(c) Where "play" is found involving the eccentric bushing, renewal will many times be the right choice. For machining alternatives, see **Eccentric Bushing Failures**, Section 2.

(d) Machine shops generally will not attempt to rebuild the teeth of a gear. If, however, only slight work is needed, this may be an alternative to consider. Finding a suitable replacement is most often the best, if not your only alternative.

Care must be taken in building up the diameter of any shaft if there happens to be a keyed interface to another part on the end of that shaft. Build-up that extends into the interface area will make final assembly an impossibility!

Section 1. Vertical Spindle and Pedestal Assembly -- Removal. (H, HN and HNH)

These two areas of the tractor will be treated as a single task set. Leaving any of the seemingly minor steps out of the sequence may introduce personnel to dangerous work situations. You should treat this outline as a basic checklist for both safety and process control, and stick with it!

Reference PC304, pages 6, 19, 20 and 21:

a. Remove medallion (nose cone) and both grilles (21-4 and 21-11).

b. Disconnect shutter control link (20-14) and remove shutter assembly (19-32).

c. Remove center plate (21-12) and radiator overflow (19-27).

d. From just in front of the radiator, remove the 7/16 x 1 inch two cap screws (21-5) retaining the front hood support (21-7) to the pedestal casting.

e. Pry up (lift) trash screen retainers (6-4) and remove trash screen (6-5).

Reference PC304, page 31/Figure 507.

f. Remove pedestal cover (8) and steering shaft bearing housing (3).

g. Remove steering wheel (14), and steering shaft (9) from the front of the pedestal.

h. Remove cotter pin and nut (42 and 43) retaining sector gear to spindle.

i. Set and lock both rear wheel brakes, and place chock blocks fore and aft of each rear wheel.

j. Using stable blocking, raise and support front of tractor to bring front wheel(s) 1 inch off surface.

k. Drive spindle down to free sector gear. Do not remove sector as this time, only make it free on shaft.

TIP -- To free spindle shaft from sector, remove cotter, nut and B3310R washer. Reinstall nut but take it down only to within about 1/8-inch of the sector. Place a block of brass or steel atop the nut (brass preferred). Then strike block SQUARELY with a five-pound hammer. The vertical shaft should drop the 1/8-inch on first blow.

l. Lower the front end of the tractor to the point where weight is barely off the front wheel(s).

m. Place chock blocks fore and aft of the front wheel(s).

n. Loosely screw nut retaining the sector gear back on the vertical spindle shaft with sector in place.

NOTE: In the steps that follow, the front wheels (or wheel) will serve as a transport aid in repositioning the entire assembly once disconnected from the front end support (PC304, 6-46).

o. Employ a light duty overhead hoist to bear the weight of the pedestal assembly during removal, and to serve as a safety hold during steps that follow. In lieu of a hoist, a helper with average agility may suffice.

p. Remove studs and/or nuts retaining pedestal casting to the front end support.

q. Using pry bars, gently work the casting studs out of the front end support, and separate pedestal assembly from the tractor.

r. With a helper to at least -- remove and reposition the chock blocks, slowly roll the pedestal assembly using the front wheel(s) to carry most of the load to a predetermined place of work.

Section 2. Vertical Spindle and Pedestal Assembly -- Renewal. (H, HN and HNH)

This section deals with the vertical spindle and pedestal assembly just removed from the tractor as outlined in Section 1. The general procedure is disassembly, cleaning, inspection and decision, rework, and reassembly. Enter into your Procurement Log, the part number and description of the items that you find missing or deem no longer serviceable. Make the entries as decisions are made. See Appendix 7, Criteria.

Procedure

References: **PC304, pages 31** and **33/Figures 507 and 508**.

Remove front wheel(s) placing all associated nuts, bolts, washers, bearings and special bits and pieces in controlled storage for cleaning and inspection. Clean spindle axles to control spread of grease. Provide protection for exposed threads. Set hubs and/or wheel(s) aside.

Remove (loosened) nut retaining sector gear on vertical spindle and sector from vertical spindle. Remove lock screw that locks eccentric bushing in place. Using a parts cleaner or suitable alternative, clean and then inspect all parts removed from the sector gear cavity, i.e., gear, eccentric bushing, lock screw, nut and washers. Discard cotter pin. Place items into controlled storage for inspection and testing.

Withdraw vertical spindle shaft from bottom of pedestal. Clean the shaft to control spread of grease; set vertical spindle shaft aside.

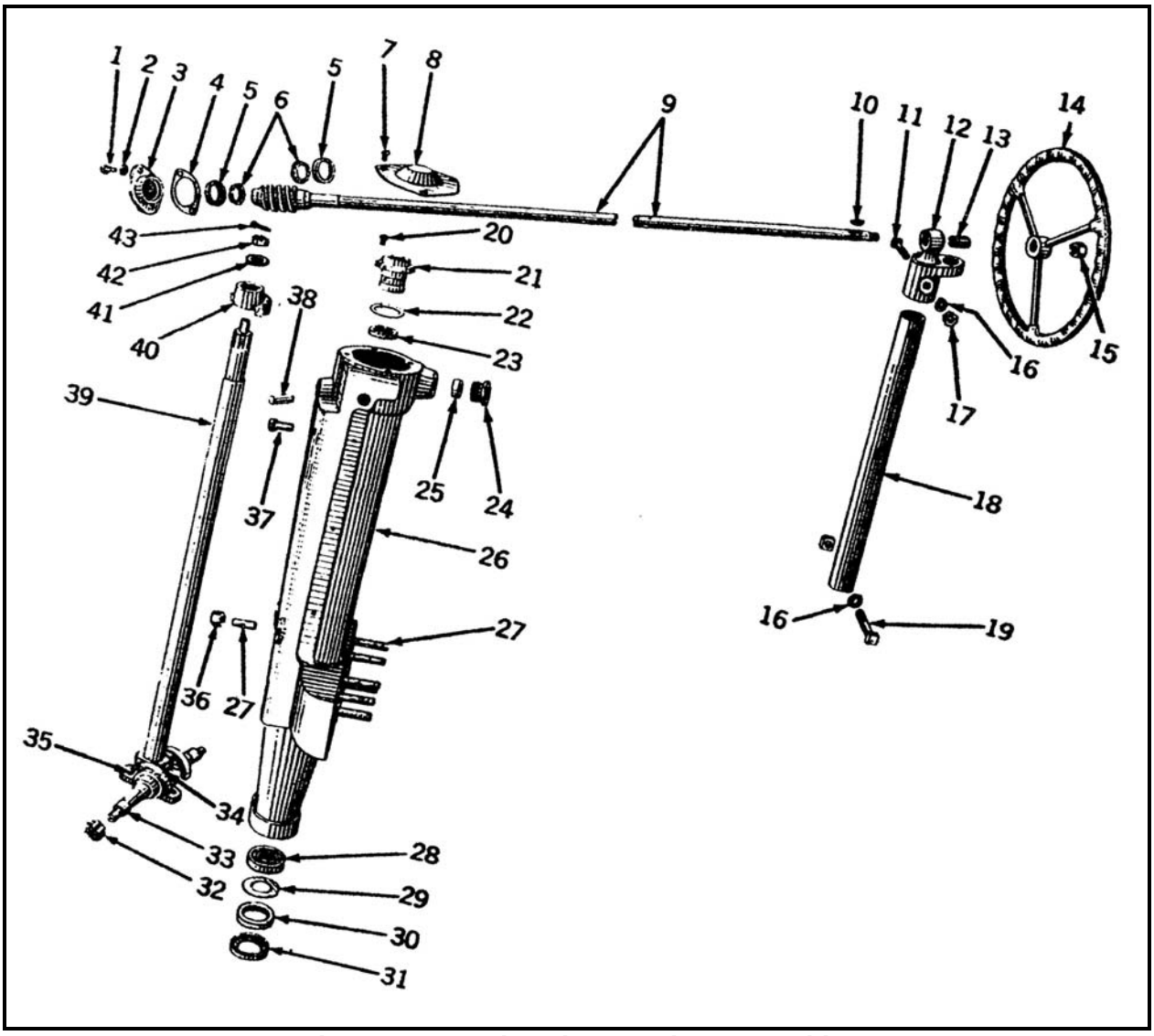


Figure 507. Pedestal & Steering Assembly

Pedestal Casting -- Inspection and Renewal, (All Models) -- Thoroughly clean the upper pedestal (sector gear) cavity. (a) Perform inspection of the 5/16-18 by 1/2 inch deep tapped hole. Operate a 5/16-18 bottom tap fully into the threaded hole, then back tap out one full turn, and then grab the tap and wiggle it back and forth. You should not be able to discern any movement of the tap from side to side. If this test fails, overbore the tapped hole, rethread and install 5/16-18 x 1/2 inch deep helicoil. Also renew the lock screw. (b) Carefully examine worm shaft bearing cup. Renew as conditions direct. This is also the time to clean and inspect the two steering (worm) shaft bearings and the bearing cup in the bearing housing removed during disassembly. Renew bearings and/or cups as conditions direct.

Remove the retainer and thrust bearing. Thoroughly clean bottom of pedestal and all parts removed. Straighten retainer for reuse, and inspect bearing. In addition to standard criteria, there should be no sideways movement of one bearing race with respect to the other.

NOTE: A thrust bearing bears weight, and by looking closely at the two race rings on one side, and then comparing them with the other, you see they are not the same. When replacing this bearing, observe that the side of the bearing having the most prominent outer race ring goes into the pedestal first. Ensure bearing (new or original) is fully packed with a good grade of wheel bearing grease before installation.

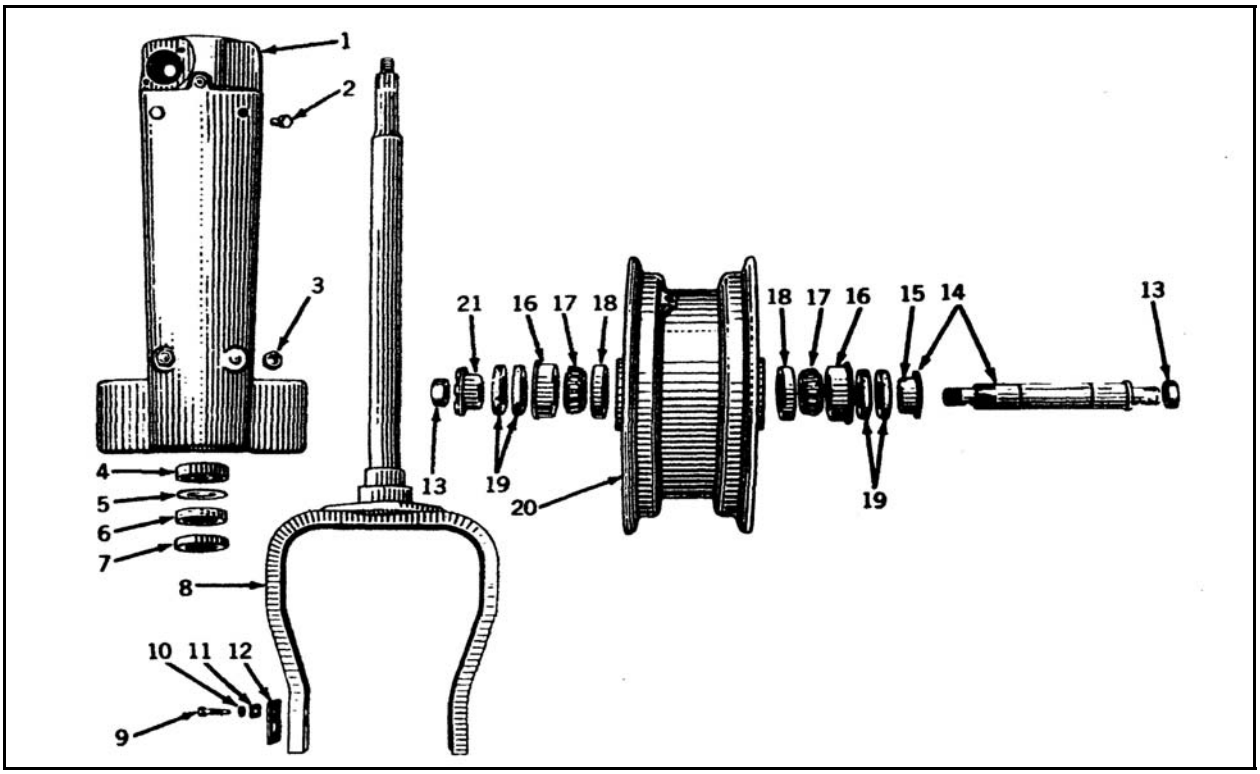


Figure 508. 'HN" and "HNH" front End

Vertical Spindle -- Inspection and Renewal -- Thoroughly clean the vertical spindle. Straightening dust covers (Model H only) if and as required. Inspect lower spindle bearing interface. It should be free of mars or burrs. If not, polish until smooth. Inspect splined region of the vertical spindle for signs of wear, and for burrs that may need to be burnished away. Don't burnish these splines un-necessarily! They need only to be clean and smooth. Check axle threaded regions (H) for riveting, burrs and cross threading. The fork tines should appear even with respect to each other, and as viewed from the side, and parallel to the vertical spindle shaft (HN, HNH).

Sector Gear Cavity Tests, (All Models) -- Using the sector gear cavity items, perform tests as follows: (a) Inspect the eccentric bushing for wear of its outer diameter which, when new, is 1.500 inches, (ID design is 1.000 inch). Wear of this dimension exceeding 0.008 inch per inch of diameter is cause for concern. Insert bushing into its normal location in the sector gear cavity of the pedestal casting. If there is any discernable radial movement, renew bushing. Slide the eccentric bushing onto the vertical spindle shaft. If there is discernable movement in a horizontal dimension, renew eccentric bushing. A last inspection item for the eccentric bushing is evidence of wear at its interface with the lock screw; the half-hole diameter should be 27/64 inch, +0.01/-0.0, and if enlarged, this area can be welded to build up and milled back to designed dimension as required. See Figure 505. (b) Closely inspect sector gear teeth, looking most critically at those in the center of the range of teeth (dead ahead position). Install cleaned sector onto vertical spindle along with its washer, and run the nut down onto the gear and tighten. If the gear doesn't seat firmly in place, you have two options: (1) shim the interface, or (2) renew the sector gear. Remove sector gear from vertical spindle shaft.

Steering (worm) Shaft -- Inspection and Renewal, (All Models) -- Clean entire shaft and inspect the worm gear on the steering (worm) shaft. Lack of worm tooth smoothness, and/or 20% (or more) loss of tooth width are causes to begin the search for a more serviceable steering (worm) shaft. Inspect shaft interface with AH581R rear bearing w/bushing (at steering wheel end). Both the shaft and bearing are at issue. If shaft OD is reduced, it must be built back up and turned to 0.750 inch. At the bearing, inspect the

bushing. If the bushing is so worn as to be missing, inspect to determine if replacement bushing (H278R) will restore the bearing. If the bearing is too worn to accept a H278R replacement bushing, your remaining alternative is to overbore and install a special bushing. Advise machinist that the 1:8 down-slope to the front in H277R casting must be maintained! (c) Inspect the worm bearing parts with criteria noted above. Make renewal decisions in accord with inspection results.

In all cases where it comes down to a choice between machining and renewal with NOS parts, the best path is to compare costs of each choice. Be sure to take probabilities of machining failure into account. The latter is an issue that will arise during interface discussions with your machinist.

Eccentric Bushing Failures, (All Models) -- There are alternatives depending on which test the eccentric bushing failed. If failure is between the pedestal casting and the eccentric bushing, a machinist may overbore the casting to press-fit a bronze bushing with ID to suit the OD of the eccentric bushing. Or it may be possible to build up and then turn down the eccentric bushing. Few other options exist. If failure is between the bushing and vertical spindle, and it is determined the vertical spindle is excessively worn (shaft OD at design is 1.000 inch), a machinist can build up the vertical spindle shaft and then turn back to fit the eccentric bushing. This is not a simple procedure because the machinist must first remove the axle weldment (H) or the fork (HN and HNH), turn the shaft, and then perform reattachment! In most cases, finding an NOS eccentric bushing is most economical and will do the job well as long as the causes of bushing wear are addressed (e.g., lubrication and a tight lock screw for the bushing).

Sector Gear Failure, (All Models) -- There is no acceptable work-around for a failed sector gear. You must face up to finding a NOS gear, probably at a high price, or keeping the existing sector gear that is likely to fail the steering backlash test.

At this point, you may elect to perform inspection and renewal of front wheels, hubs and axles in accordance with Section 8, and then return to Section 3 below (H, HN and HNH), or Section 6 (HWH).

Section 3. Vertical Spindle and Pedestal Assembly - Reinstallation (H, HN & HNH)

Preliminary:

a. Pack JD7698R/JD7684R thrust bearing, and lightly oil H546R/H764R cork washer.
b. Pack two JD7364R worm shaft bearings
c. Pedestal assembly is dismounted from the tractor

Assumptions Made: That the pedestal and vertical spindle have been removed from tractor's front support frame for maintenance and/or renewal activity and are ready to be reinstalled.

Ref PC304, page 31/Figure 507, and Figure 501 (H):

1. Fetch Pedestal. Install pre-packed JD7698 bearing (28), thrust washer (29), clean, lightly-oiled cork washer (30), and retainer (31).

2. Integrate AH1072R vertical spindle (39) up into pedestal. To ensure spindle remains in place, temporarily install eccentric bushing, sector gear, washer and nut. Secure but do not cotter pin. Do not install cork packing(23). See Section 9, Adjustments.

Ref PC304, page 33/Figure 508, and Figure 501 (HN, HNH):

1. Fetch Pedestal. Install pre-packed JD7684 bearing (4), thrust washer (5), lightly-oiled cork washer (6), and retainer (7).

2. Integrate AH843R vertical spindle (8) up into pedestal (1). To ensure spindle remains in place, temporarily install eccentric bushing, sector gear, washer and nut. Secure but do not cotter pin. Do not install cork packing. See Section 9, Adjustments.

For H, HN and HNH:

Re-install front wheel(s) using bearings and regular nuts (do not pack bearing or tighten wheel nuts at this time).

Mount pedestal and vertical spindle assembly onto front support frame, using 5/8-inch nuts and trash screen retaining clips, onto studs. Snug pedestal to the right side of tractor to ensure there will be clearance between steering shaft and muffler. Tighten to torque of **150 foot-pounds**.

Support blocking may now be removed to allow front wheel(s) to bear tractor weight.

If top transmission cover has been removed, temporarily install cover and steering wheel support S/A to provide AH581R bearing (PC304, page 31-12) to support to steering (worm) shaft. Attach using two 3/8 x 1 inch cap screws.

Install steering shaft with bearings using one medium gasket, using two 3/8 x 1-1/4 inch cap screws w/lock washers. Hand-tighten only. Temporarily mount steering wheel w/woodruff key and nut.

For H, HN & HNH tractors, go to Section 8 or 9.

Section 4. Vertical Spindle and Pedestal Assembly -- Removal. (HWH)

These two areas of the tractor will be treated as a single task set. Leaving any of the seemingly minor steps out of the sequence may introduce personnel to dangerous work situations. You should treat this outline as a basic checklist for both safety and process control, and stick with it!

Ref PC304, page 21 (Hood and Grilles):

a. Remove medallion (nose cone) and both grilles (4 and 11).
b. Disconnect shutter control link (PC304, 20-14) and remove shutter assembly (PC304, 19-32).
c. Remove center plate (12) and radiator overflow (PC304, 19-27).
d. From just in front of the radiator, remove the 7/16 x 1 inch two cap screws (5) retaining the front hood support (7) to the pedestal casting.
e. Pry up (lift) trash screen retainers (PC304, 6-4) and remove trash screen (PC304, 6-5).

Ref PC304, page 31/Figure 507:

f. Remove pedestal cover (8) and steering shaft bearing housing (3).
g. Remove steering wheel (14) and steering shaft (9) from the front of the pedestal.
h. Set and lock both rear wheel brakes, and place chock blocks fore and aft of each rear wheel.
i. Using stable blocking, raise and support front of tractor to relieve front wheels of weight.

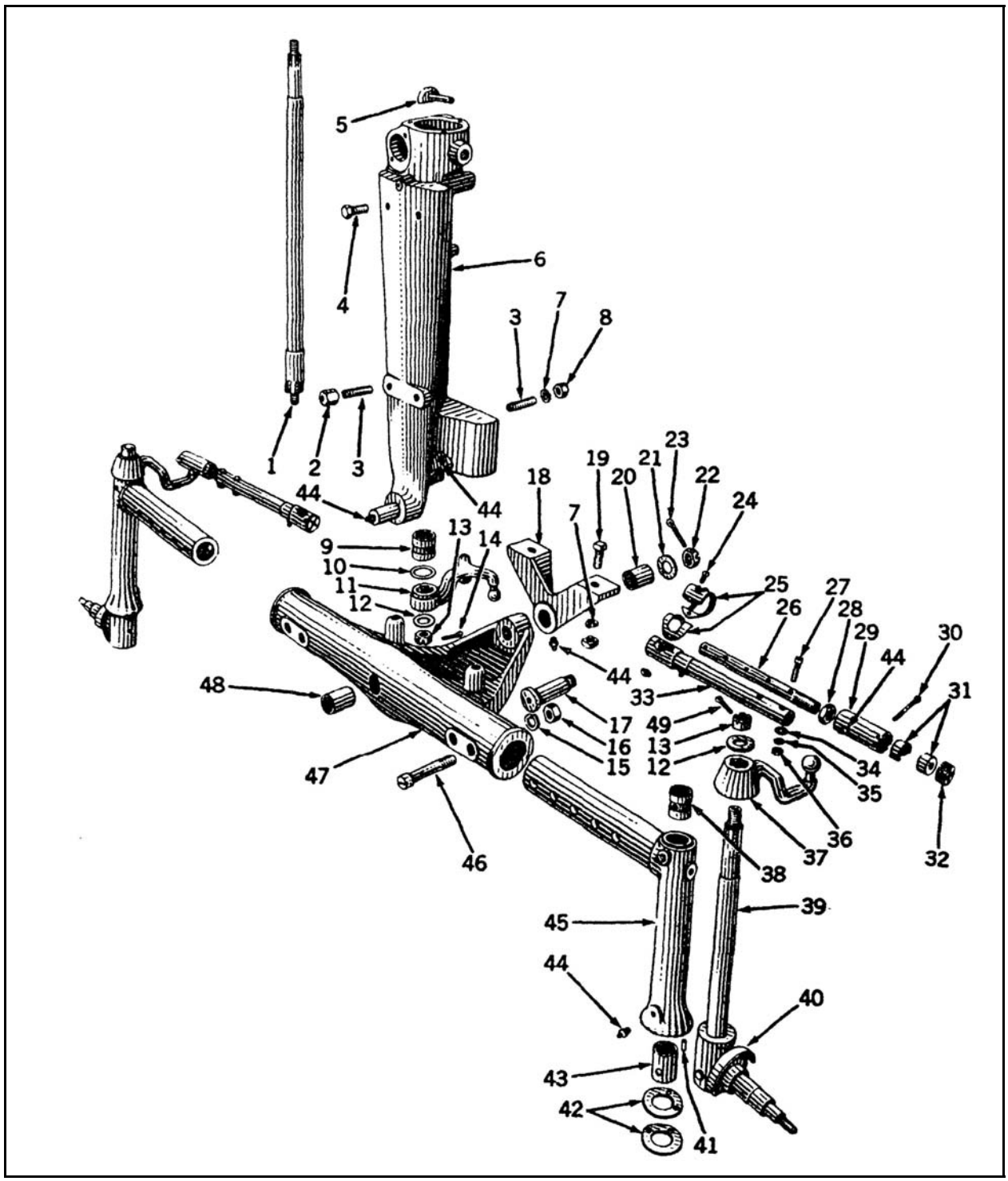


Figure 509. "HWH" Front End

Ref PC304, page 32/Figure 509:

j. Remove rear pivot pin (17).
k. Slide axle assembly forward and off of the front pivot pin (44).
l. Disconnect steering arm (11) from the vertical spindle shaft (1).
m. Bring the front axle assembly forward and out from under the tractor -- to a storage area.
n. Employ a light duty overhead hoist to bear the pedestal assembly during removal, and to serve as a safety hold during steps that follow. In lieu of a hoist, able-bodied help should suffice.

o. Remove studs (3) and/or nuts (8) retaining pedestal casting to the front end support.
p. Using pry bars, gently work the casting studs out of the front end support frame, and separate pedestal assembly from the tractor.
q. With a helper, reposition the pedestal assembly to a predetermined place of work.

Ref PC304, page 31/Figure 507.

r. Remove cotter pin (43) and nut (42) retaining sector gear (40) to spindle.
s. Drive spindle shaft out of the sector gear, and remove vertical spindle from pedestal.
t. Place all small parts removed from the sector cavity in suitable parts cleaner. Parts include the sector gear and its washer and nut, eccentric bushing and its lock screw, and shims if any.
u. Discard the cotter pin.

Section 5. Vertical Spindle and Pedestal Assembly -- Renewal. (HWH)

This section deals with the vertical spindle and pedestal assembly just removed from the tractor as outlined in Section 4. This procedure encompasses disassembly, cleaning, inspection and decision, rework, and reassembly. Enter into your Procurement Log, the part number and description of the items that you find missing or deem no longer serviceable. Make the entries as decisions are made. See Appendix 7, Criteria.

References: **PC304, pages 31, 32** and **33 (Figures 507, 508 and 509)**. Also see pictures of wear in sector gears (figure 506) and repair of the eccentric bushing (figure 505).

Procedure:

Clean and inspect all parts removed from the sector gear cavity, i.e., the gear, eccentric bushing, lock screw, nut and washers using a parts cleaner or suitable alternative. Discard the cotter key. Place items into controlled storage for inspection and testing.

Clean vertical spindle shaft to control spread of grease. Inspect the vertical spindle where it interfaces with the lower pedestal bushing (PC304, page 32-9). This shaft area should be free of mars and burrs, and if not, polish until smooth. Inspect splined region of the vertical spindle for signs of wear, and for burrs that may need to be burnished away. Don't burnish un-necessarily here! It needs only to be clean and smooth.

Pedestal Casting -- Inspection and Renewal -- See Section 2.

Sector Gear Cavity Tests -- See Section 2.

Test the lower bushing -- Thoroughly clean bottom of pedestal. Apply a light coat of oil to pedestal lower bushing and reinsert cleaned vertical spindle shaft. Temporarily install eccentric bushing, sector gear, washer and nut. Tighten nut by hand only. Vertical spindle shaft should now be in its operating position. Attempt to move the bottom end of the vertical spindle shaft in relation to the lower spindle shaft bushing. Discernable radial movement indicates the need to renew the A877R (PC304, page 32-9) lower pedestal bushing -- still current in Deere inventory as of September 15, 2005.

Steering (worm) Shaft -- Inspection and Renewal -- See Section 2.

Eccentric Bushing Failures -- See Section 2.

Sector Gear Failure -- See Section 2.

Section 6. Vertical Spindle and Pedestal Assembly -- Reinstallation. (HWH)

Preliminary:
a. Pack two JD7364R worm shaft bearings.
b. Pedestal assembly is dismounted from the tractor.

Assumptions Made: That the pedestal and vertical spindle have been removed from tractor's front support frame for maintenance and/or renewal activity and are ready to be reinstalled.

Position Pedestal on a work surface. Integrate vertical spindle up into pedestal.

Secure spindle in place -- temporarily install eccentric bushing, sector gear, washer and nut. Tighten by hand and do not cotter pin. Do not install cork packing. See Section 9.

With aid of the overhead hoist, mount pedestal and vertical spindle integration onto front support frame, using 5/8 nuts and trash screen retaining clips, onto studs. While not much, there IS room for some left-to-right movement of the pedestal casting once mounted and before tightening the fasteners. Snug pedestal to the right side of tractor to ensure there will be clearance between steering shaft and muffler. Tighten all fasteners to torque of **150 foot-pounds**.

Bring the front axle and wheel assembly back under the tractor - in position to reinstall.

Onto the bottom end of the vertical spindle shaft, mount (a) B233R washer, H966R center arm, B3310R washer, and then the F2664R nut. Using suitable tooling, tighten nut and install new 1/8 x 1-1/4 inch cotter pin.

Continue to slide front axle and wheel assembly to the rear, and onto front pivot pin. Install rear pivot pin and washers; tighten and secure with 3/16 x 1-1/2 inch cotter pin.

Front support blocking can now be removed to allow front axle and wheel assembly to bear the tractor weight.

If top transmission cover has been removed, temporarily install cover and steering wheel support S/A to provide AH581R bearing (Figure 503-12) support to steering (worm) shaft. Attach using two 3/8 x 1 inch cap screws.

Install steering shaft using one medium gasket, using two 3/8 x 1-1/4 inch cap screws w/lock washers. Hand-tighten only. Temporarily mount steering wheel w/woodruff key and nut.

Section 7. Front Axle Subsystem -- Removal, Renewal and Reinstallation (HWH)

The tie rods and drag links, steering knuckles and bushings, and axle pivot pins and bushings are the three main areas of this subsystem.

Tie rods and drag links -- Removal, renewal and reinstallation for the tie rods and drag links is self-evident. The two acceptance criterion are (a) adjust tie-rod and drag link ends so they have no end play and yet do not bind, and (b) a recommended toe-in adjustment of between 1/8 and 3/16 inch. Replacement drag links and bearings remain available from Deere & Co. at this writing.

Steering knuckles, and axle pivot pins and bushings

Removal -- Support the front of the tractor and remove rear pivot pin. Slide axle assembly forward and off of the front pivot pin that is pressed into the pedestal casting. Remove pivot bracket from the tractor. Disconnect steering arm from the vertical spindle shaft. It may be necessary to raise the tractor a bit more with the objective to bring the front axle assembly forward out from under the tractor -- to a work area.

Renewal -- This area of the front end is a machinist operation so far as renewal is concerned. Replacement bushings and pivot pins are no longer current in Deere inventories. When they were, the wheel spindle bushings were pre-sized to provide 0.009 to 0.012 inch clearance in relation to the wheel spindle shaft. The vertical end play call-out is 'not more than 0.036 inch for each wheel spindle, and this range is set by shimming the spindle shaft between the spindle steering arm and the knee (upper bushing flush with top of knee). The shims aren't part numbered, nor described. Therefore, search the market for shims by ID, OD and thickness of 0.036 inch or less to fulfill this requirement. For axle pivot pins and bushings with no clearance call-outs, "machinist's tolerances" apply for procuring and installing replacement pins and bushings which are no longer current in Deere inventories. If the front pivot pin is to be renewed, remove the pedestal from the tractor for press-out, and press-in operations. A mild application of heat will facilitate removal and installation of the front pivot pin. Maintaining cleanliness is essential throughout renewal, inside and out. Renew all grease fittings and apply lube through them to ensure passageways are 100% open.

Reinstallation -- The process is basically a reversal of steps for removal. However, when reassembling this front end, make certain that the dowel pins (lower end of knee) engage the two thrust washers that go between knuckle and bottom of knee. While no mention is made relative to wheels, the same cleaning, bearing inspection criteria, and reinstallation rules apply here as with H, HN and HNH tractors, Section 8 below.

Section 8. Front Wheels, Hubs and Axle -- Inspection and Renewal (all models)

Front wheels, hubs and axle.

H and HWH -- clean and inspect the bearings and bearing cups in wheels and/or in hubs. Remove and clean the two felt washers (dust shields) from inside each hub or wheel, and inspect inner bearing of each for usual signs of wear or corrosion and renew as appropriate. Cover and/or close wheel/hub cavities to keep out foreign objects; clean and store hub caps.

HN and HNH -- remove the bearing adjustment nut and withdraw axle from wheel. Remove and clean the four felt washers (two on each end) and store, clean bearings and bearing cups and inspect for wear and corrosion; make renewal decisions as appropriate. Cover or close wheel cavity to keep out debris and/or foreign objects. Carefully inspect the axle for riveting of axle threads and/or evidence of cross threading. Chase threads as appropriate. Clean and straighten H773R dust excluder covers as required and store for further disposition (Covers are not illustrated in PC304).

TIP: DO NOT presoak the felt washers for front wheels. If you do -- there will be signs of "bleeding" from the presoaked felt washers for a long time! These washers may be "washed" with fluids compatible with regular bearing grease, but should be fully drained, brought to a near-dry state, and then gently "massage" clean engine oil into them much as you would into the air cleaner sponge for a lawn mower engine prior to reinstallation. The purpose of these felt washers (two are used in every instance) is to guard the bearing, keep out the dust, and keep in the grease, not to lubricate!

Whatever action of renewal is to be done on wheels to include sand blasting and paint, and R/R of tires, this is the time to begin. If submitting wheels and/or hubs to sand blast, cover and seal bearing cavities. One method here is to fit plastic lids (from the kitchen) into the inner end of the hub (Both ends for HN, HNH), and seal with RTV. Seal the outer end (H, HWH), remount hub cap with gasket. For pressed steel front wheels, if your rims need extended repair, see "wheels" in chapter 6.

TIP: Repainted wheels should have sufficient cure time before remounting tires; one week for paint with hardener and up to a month for paint without hardener.

Front Wheel Bearing Load -- The front wheels are carried on taper-roller bearings. When installing the wheels, or performing periodic maintenance, draw bearing to achieve some drag, then back off a small bit. Front wheels should rotate freely but without end play. See Operator's Manual for specific guidance.

Section 9. Pedestal, Spindle and Steering Shaft -- Adjustments (all models)

(Reference Field Service Bulletin 110-S, June 15, 1940)

Testing and Adjustments -- Shaft end play adjustments are independent of each other, but both should be made prior to the adjustment for backlash. The steering shaft end-play adjustment is best made without sector gear in place.

Steering shaft end play -- Adjust by adding gaskets (no sealers yet) to steering shaft bearing housing. There should be no discernable end-play, yet shaft must rotate freely. Bag & tag resultant gasket set, or record total number of gaskets needed; _____ thin, _____ medium, and/or _____ thick gaskets.

Vertical spindle shaft end play -- Must be worked with the steering (worm) shaft removed, and before installing the H199R cork packing. Adjust using H198R shims. Maximum vertical spindle shaft end-play is 0.032 inch. For model HWH tractors, use suitable pry bar to force vertical spindle upward during test for end-play. Record quantity of shims needed ___ shims.

Installing the cork packing (H199R) into steering pedestal -- See PC304, page 31/Figure 507, for the cork packing (23), then shims (22), and then followed by the eccentric bushing (21), sector gear (40), washer (41), nut (42) and cotter pin (43). The milled area, in the pedestal casting, down into which the cork packing goes is less deep than the cork packing; this being the way of providing a seal.

TIP: The approach is to perform the spindle shaft end-play shim adjustment without the cork packing to determine how many shims are needed. Then remove sector gear and shims, and install the new cork packing (presoaked in oil) into the designated region. The packing is then compressed into place beneath the H197R eccentric bushing using a predetermined quantity of shims (the quantity a result of the spindle end-play adjust procedure), the H200R sector gear, washer, nut and (once the nut is tightened) the cotter key.

Backlash -- Follows the End Play Adjustments -- Reinstall steering shaft with bearings and the quantity of thin gaskets added during steering shaft end play adjustment above, and tighten shaft bearing housing securely. To ease the effort of turning the steering wheel, you may elect to raise the front end slightly; i.e., the front wheel(s) are still bearing some weight. Adjustment is by rotating eccentric bushing. By trial and error, obtain as little as possible steering backlash, yet steering shaft should rotate freely.

Caution -- Be sure to check backlash at the extreme right and left where wear is the least. Making this setting in the dead-ahead position only will often result in binding when turned fully to the left or to the right. Acceptable backlash is from 1/2 to 1 inch for new tractors, and as much as 2 inches for vintage tractors -- as measured at the rim of the steering wheel.

TIP: As noted earlier, overcoming some areas of non-compliance may be cost-prohibitive. This adjustment is one of those areas. Strive for the 1 inch of backlash, but if gear binding starts at 1 inch and is avoidable by a slight increase, the increase is the prudent choice. The alternative is to find serviceable replacement(s) for either the sector gear, the worm gear, or both!

Remove steering wheel and steering shaft, and set them aside for further work. Close the top of the pedestal housing to keep foreign materials out. Reinstall steering shaft bearing housing with all of its gaskets onto pedestal as temporary closure, and secure worm shaft bearings. The upper transmission cover and tower S/A may be removed as required for further work.

TIP: If the backlash adjustment was made previous to installing the cork packing, make note of the position of the eccentric bushing so that it may be reinstalled in the same position -- thus preserving the adjustment.

Lubrication -- Lubricate steering gears in pedestal with transmission oil. Add oil until the oil level is even with the BOTTOM of the sector gear. Be careful! If too much oil is added to this housing, the excess will run down the pedestal shaft and leak out at the bottom. (See FSB 110-S, June 15, 1940).

TIP -- A widely adopted lubricant is Corn Head Grease. It is a thin, sticky grease originally intended for lubing gearboxes on corn heads. It has a curious kind of viscosity in that it flows a bit, like oil, rather than wadding up like regular bearing grease does. Corn head grease is finding wide use in steering gearboxes because it stays in the gear teeth yet won't drip through worn seals as quickly as oil will.

Statement of Work [Sample]

(Steering Worm-shaft Machining)

Problem:

Rear bearing for steering worm-shaft worn to excessive oversize of 0.750 inch shaft; too much to simply replace H278R bushing.

Criteria:

While there should be freedom of movement allowing worm-shaft to be slipped into and out of H277R bearing point, the amount of discernible "play" shall be 0.002 inch, or less.

Machine Work to be Done:

Install bronze bushing of suitable size (nominal 0.750 inch ID x 1.000 inch OD x 1.3750 inch long) into H277R bearing casting, then drill bushing to open grease fitting hole. The ID of the bushing must fit, albeit loosely, over the first 12.50 inches of the worm-shaft as seen from the threaded end; this dimension includes the threaded portion of the worm-shaft.

FIRST CAUTION note: Whatever the dimension of the worm-shaft is at the bearing point (previously built-up area) will determine what the diameter of the entire 12.50 inches (mentioned above) shall be! The previously built-up area is between 10 and 13 inches from the threaded end of the worm-shaft. This measurement is the determinant.

SECOND CAUTION note: -- The downward slope of the steering worm-shaft must be preserved. This is a very important point, and a special holding device may have to be fabricated by the machinist to hold the H277R casting when it is being drilled to accept the new bushing. The "down-slope" is approximately 1:8.

Items to be delivered to Machinist:

1. Bronze bushing, 0.750 x 1.000 x 2.000 inches long (Source: Ace Hardware).
2. H277R Bearing Casting without grease fitting.
3. AH578R Worm-shaft S/A.

////////////////////// End of Statement //////////////////////

My Dog Skip

An avid duck hunter was in the market for a new bird dog. His search ended when he found a dog that could actually walk on water to retrieve a duck. Shocked by his find, he was sure none of his friends would ever believe him.

He decided to try to break the news to a friend of his, a pessimist by nature, and invited him to hunt with him and his new dog.

As they waited by the shore, a flock of ducks flew by. They fired, and a duck fell. The dog responded and jumped into the water. The dog, however, did not sink but instead walked across the water to retrieve the bird, never getting more than his paws wet. This continued all day long; each time a duck fell, the dog walked across the surface of the water to retrieve it.

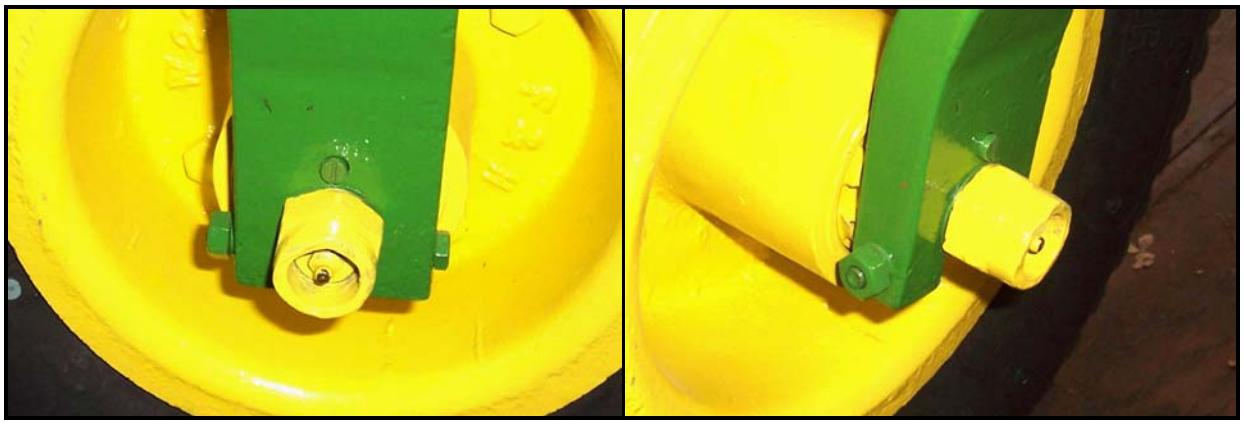
The pessimist watched carefully, saw everything, but did not say a single word.

On the drive home the hunter asked his friend, "Did you notice anything unusual about my new dog?"

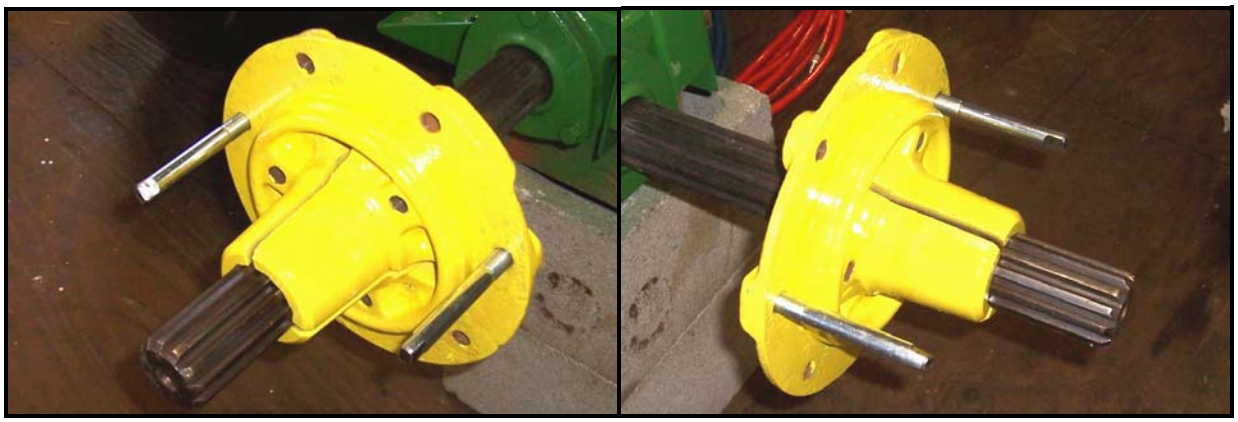
"I sure did," responded the pessimist. "He can't swim."

Here & There

1935 JD-B Steering Wheel (left) and 1941 JD-H Steering Worm (right)



1935 JD-BN Front Axle Set Up



Two guide-pins made from 9/16 x 5 inch long bolts, to assist in rear wheel mounting. Note the heads of these pins are shaped for Adjustable wrench use to install and to uninstall.

Basic Tractor
Chapter 6

Wheels – Neither factory steel nor spoked wheels were ever options for Model "H" tractors. Rubber tires for pressed steel rear wheels was the one single design from H1000-up. The earliest JD "H" tractors were offered with 6-inch rims and 7-32 tires. And 8-32 tires were offered at extra cost. The 6-inch rear wheels were JD 1241R. Note that rim width is measured inside of the seat for the tire bead, and not overall. Within months, 8-32 tires became regular-issue, and soon rear wheel sizes JD 1252R (7-inch) and JD 1251R (8-inch) were introduced for 8-32 and 9-32 tires respectively. It is interesting to note that only JD 1251R is listed in PC304, and is identified as a substitute for JD1241R and JD1252R. Wider tires soon became the norm, and PC304 does not reflect history unless form, fit or function is affected. Front tires were 4.00 x 15 throughout, mounted on cast wheels through H47795, and pressed steel for H47796-up.

Tire Size versus Rim Width -- All manner of combinations can be expected. It is common to find a tractor with rims of differing widths as well as tires that differ. Tire and rim replacement become an apparent challenge. Availability will largely dictate your course of action. Replacement tires are generally available only in the 9-32 size (now 9.50-32). I am finding the same to be true for rims, i.e., only size 8-32 to match the 9.50-32 tire is readily and economically available. Concern may come to you mounting a 9-32 tire on your tractor having smaller and differing rims! Don't panic. Consider the effect of rim width on tire appearance. Going from a rim that is 6-inches to one that is 8-inches means a 2-inch increase of "inflated balloon circumference"; resulting in a tire balloon width increase (diameter) of roughly 2/3 of an inch. More than likely, only YOU will know!

Rare Rear Wheel Combination -- The January - February 2006 issue of Two Cylinder Magazine documents a rare combination that few "H" owners or collectors may have heard of. It is a special short axle, P/N AH1160R with 14H656R nut to fit the end of the axle. The axle's hub splines were slightly tapered to fit into special hub H997R that was machined to match the seven-hole pattern of the 32-inch wheels described above. I am aware of at least one such "sighting" and it is believed to have been at an estate sale in Idaho. Judging from the heritage of the of the estate holders, the tractor very likely originated in California. **Invitation --** If you find one of these short-axle gems, please write to the author via (www.jdhpubs.com). Include the serial number, owner's name plus his/her contact data, and something about the tractor.

Condition versus Cost -- While wheels may seem an area quickly examined, cost can get out of hand rapidly, and there really is a lot to consider. Look for broken clamps, cracked castings, severely eroded cap screws, and missing items. Take special note of the condition of the rims. Corrosion or erosion around the valve stem hole is usually the biggest concern. This damage is almost always a direct result of farmers using a solution of calcium chloride and water inside the tubes for added weight. Such corrosion can also come from continued contact with barnyard waste as in the front wheels. Also, be wary of a wheel sprung out of alignment.

Repairs -- Corrective action solutions can range from a welder's slight touch here and there to a major welding job, or total replacement. One workable solution for an "eaten-out" valve stem hole may be to weld a flat washer of the right size (1/2, 9/16, or 5/8 inch, etc.) on the inside of the

rim. Once welded in place, backfill voids on both sides; on the inside to provide a smoother surface for the inner tube. Some cosmetic grinding will normally follow as needed. Your local machinist, steel fabricator, and/or welder may prove to be helpful sources of advice.

For broken or cracked hub and lock ring cast iron parts, serviceable replacements are the best alternative until such time these are no longer available. Should this become the case, some form of repair becomes the only alternative.

There will be cases where a rim is unserviceable. That is, it can't be repaired, but the center part of the wheel (or dish) remains strong. You have two options. One is to find a serviceable used wheel, and the other is to mount a new rim on the still-serviceable dish – not a job to take lightly!

Where can one find serviceable replacement parts? See Appendix 3 for a list of reputable sources. If they don't have what you need, they will usually know someone who can help. Beyond these vendors, subscriptions to Green Magazine and Two Cylinder come in handy. They are full of ads by vendors of specialized services. As always, ask for references when dealing with "big ticket" items. Just because they have an ad in Green Magazine doesn't verify they are reputable! EBay shoppers should check a seller's feedback and return policies. " Hard to get along with' people seldom have good "hang time" on eBay.

Rear Wheel Removal -- See owner's manual for general guidance, and Appendix 12 for hubs well-rusted place, for hubs that haven't been moved for years, perhaps decades!

Figure 601 (A&B). Step 1 in the 3-step process of "Spruce Up"

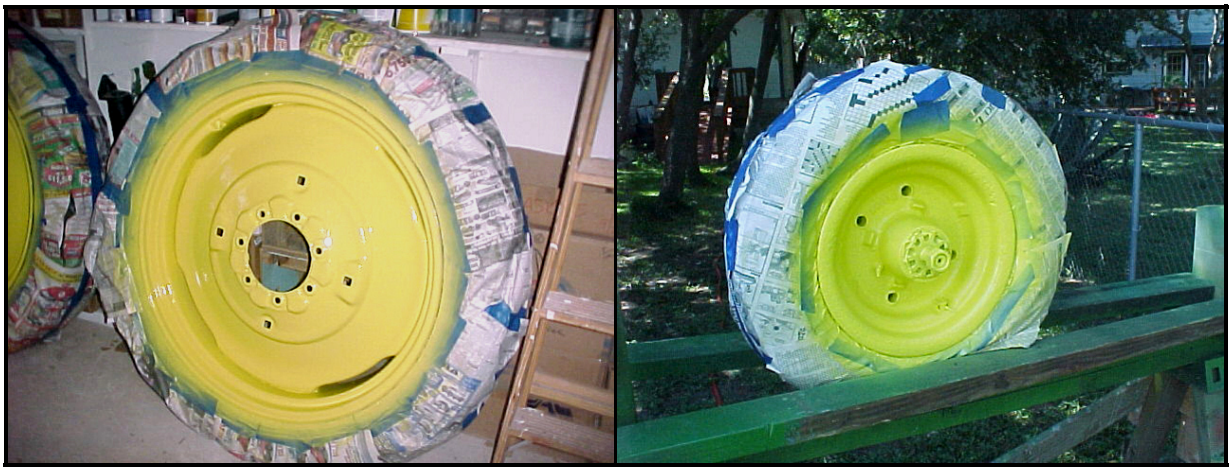


Figure 602 (A&B). Step 2 in the 3-step process of "Spruce Up"

Figure 603 (A&B). Step 3 in the 3-step process of "Spruce Up"

Tires, Reuse or Replace -- Here the range runs from practically new to fully unserviceable. These two limits present no challenge. Thus, this discussion will assume your tires are something less than new but still have some years of service to provide, and you intend to continue using them. The approach you take with the rubber is dependent on your total objective with the tractor, and your operating budget.

Spruce Up; Replace Rubber Later -- A "spruce up" is catching the tractor up on all maintenance items, renewing all missing parts, and generally making it "field-ready", followed by a paint and decal job. The tractor should look nice! The alternate case is that your rubber may be okay for now and your budget isn't! If you are going to install new rubber at a later date, plan to submit the wheels to sand blasting at that time. Accordingly, the old rubber will be dismounted prior to sand blast.

See Figures 601, 602, and 603 -- For this approach, a series of three steps are involved: (1) rims and wheels are wire brush-cleaned to bare metal, using paint stripper as needed to help remove hard paint; applying OSPHO or Rust Converter to protect the metal surface, and allowing an overnight cure, (2) more wire brush cleaning and sanding to prepare for primer, masking rubber tire off to protect it against over-spray (deflating tire helps here), applying primer and allowing adequate cure time, and then another sanding and application of final paint in suitable quantity of coats to achieve the desired result, and finally, (3) remove masking materials, re-inflate the tire, and brush onto the tires a two-coat application of black tire paint.

Full Restoration -- Here, sand blasting the wheel is the essential step. Dismount the rubber and make repairs on the rim as required. Evaluate the tires to decide whether or not to buy new ones. Submit metal wheels to sandblasting and epoxy primer paint.

TIP: If tires are to be remounted but have "over the years" grime or paint build up on them, sandblasting is a great method for cleaning them. They come out looking like new. **CAUTION**: Protect the bead, duct tape over it if necessary; plus instruct the sand blast man to go real easy on the bead!

TIP: Application of black tire paint will further beautify the cleaned tire. Once sand blasting and prime coating is done, sand or wire brush the metal wheels, clean with tacky cloth and apply coats of paint in the usual fashion. After allowing sufficient cure time, rubber can be mounted. I need to add here that application of black tire paint can be effective in covering paint over-spray on tires if this should happen!

For Mounting Tires on Restored Wheels, see Operating **TIP** later in this chapter.

For rear wheel hub clamp cap screws -- clean, chase and paint using Muffler Black - two thin coats. Also, take the coil out of the 5/8" lock washer and paint them too! The bolts look sharp & there is no ugly cutting into the paint on hub clamps when having to back them out!

For those rear axles -- using all manner of tooling, clean down to shiny bare metal. Then without passage of time, apply one coat of JD Graphite Lubricant that comes in aerosol form from your JD Ag Dealer. This compound blackens, lubricates, protects against rust, and preserves.

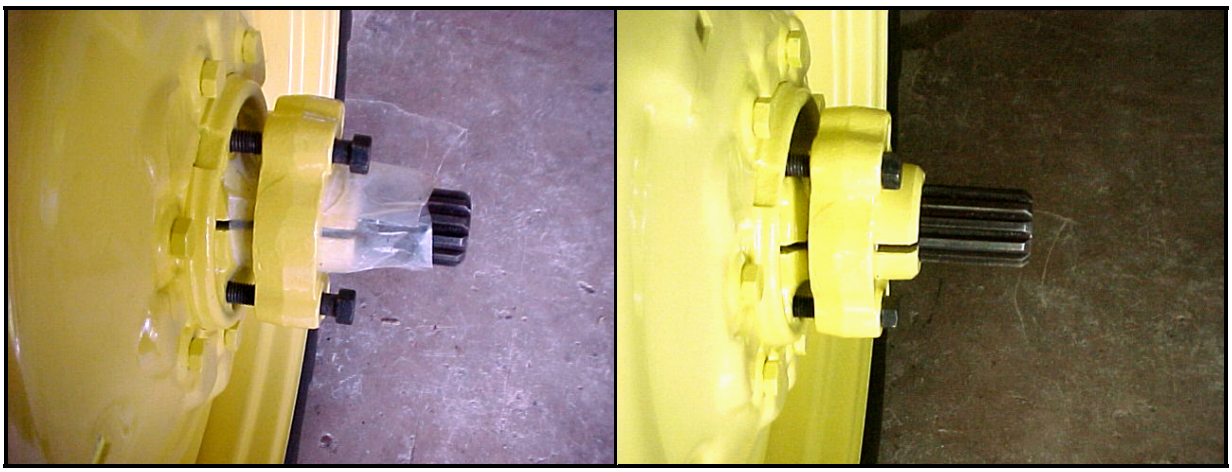


Figure 604 (A&B). During final assembly, insert ordinary kitchen waxed paper between the clamp and hub to prevent a "paint bond". After drawing the bolts tight, remove the excess.

The Seat – Tractor owners often debate the number of holes to be found in the AD1606R pan seat for a given production year tractor. According to reliable sources which includes the Two-Cylinder Magazine, near-universal use of this seat was for all styled tractors equipped with a pan seat, but the number of holes changed over time! From the beginning, until some time in late 1941 production, the seat had 9 holes. Then it was changed to a 7-hole pattern that held through most of 1944 production. Beginning with 1945 you should expect to see 5 holes. It appears a 3-hole decision was implemented by late 1946, and continued into 1947 when this seat was phased out on A, B and G tractors. See three-holed seat pictured at chapter's end. Widely used on later tractors, AD1606R remains available from Deere, but it comes with ZERO holes – even-though later parts catalogs show three holes! During the early US tractor era, tractor seats had far more than 9 holes. 'Interesting to observe! For the full, expanded discussion of Pan Seat history, see Appendix 15.

Seat Repair -- Most likely, your seat will have been sat upon too much. Seats and drawbars top the list of broken things. For the seat, the two most common problems are the center part is rusted and bent out of shape, and there will often be some cracks which have their beginning under the center part. The cracks need to be welded so that they are arrested! Follow the welding with some grinding and smoothing to suit your desired result. Aftermarket kits consisting of two predrilled plates and rivets are available for seat renewal. During final assembly, orient those prominent round rivet heads down. The rivet heads ensure seat alignment with the seat support channel. Once installed, you have a NEW seat!

Mechanical Means of Seat Alignment is a Necessary Feature -- If the rivets supplied to you aren't steel, or if they don't have the full-round head, do not use them. Find rivets that will do the functions called for here. You can always use bolts as an interim plan -- as viewed in the figure below. Here we use the nutted end of ¼ x ½ inch long pan head screws to serve "alignment pins" versus the seat channel. **Alternately** -- There are predrilled plate repair kit sets in the marketplace with the bottom plate having a pair of protrusions on each side to nudge against the seat support and thus perform the alignment function. In this case, the rivet head design is no longer an issue.

Figure 605 (A&B). A – Cleaned up and welded. Aftermarket seat repair kit is installed. Large head rivets not yet available, thus temporary fasteners of 1/2 inch long Phillips-drive pan-head machine screws and nuts with lock washers were used. B - Note here that in lieu of the large rivet heads, the nuts will serve the function of preventing the seat from turning because the nuts fit snugly along the edges of the seat channel support.

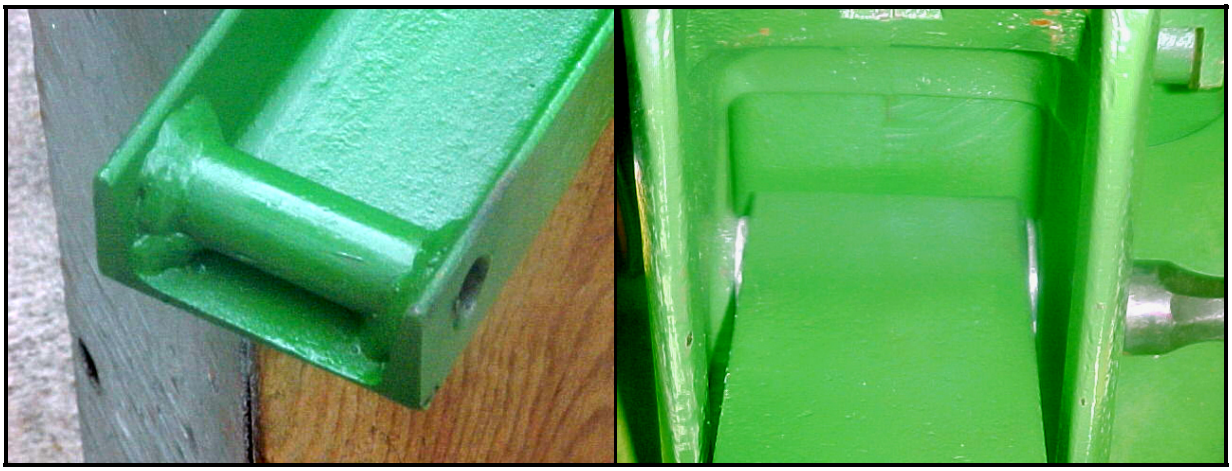


Figure 606 (A&B). A - Bushing welded in place. Used 1/2 inch galvanized water pipe, chamfered each end to fit the seat support channel, and 1/2 inch diameter bolt was installed during the weld operation to ensure alignment. B - Here we have 1/2 inch flat washer installed on each side of the seat support channel to take up excess play from side-to-side.

The Seat Support -- You will most likely find the seat support (H370R) worn excessively in two places: (1) at its lower pivot point, and (2) at the slot through which the spring bolt passes (the big one). One remedy is to weld a 1/2 inch ID bushing in at the pivot point, and renew the pivot pin. Bolt it in place during the initial welding operation steps.

Then, weld to build up and trim the spring bolt slot to its original configuration. There may also be a cosmetic issue with the seat support. It is the upper surface between the seat casting and seat where the "MODEL H" decal goes. This region is always pitted. During the paint preparation process, apply fillers to bring about a smooth surface for your decal.

Drawbars, A History -- In the beginning, the JD "H" tractor drawbar configuration was the AH508R swinging drawbar and AH507R support along with the AH509R bracket assembly. At H-7186 late in 1939 production, the swinging drawbar and support became the H675R and AH772R respectively. During the early part of calendar year 1943, Deere & Co. announced programs to adapt to the new

American Society of Agricultural Engineers Standard for Power Shafts and Drawbars. More change was coming!

Field Service Bulletin 148-S, (6-15-44) defined the standards; (1) Power shaft diameter increased to 1-3/8 inches (1-3/4 inches also considered standard!), (2) Hitch point on drawbar located 4 inches beyond rearmost part of the tractor wheels, (3) Power shaft lengthened so that distance between the end of power shaft and hitch point was 14 inches, (4) Drawbar at hitch point located 12 to 15 inches above ground level, (5) Drawbar located 6 to 15 inches below centerline of the power shaft, and (6) Safety shields provided for those tractors in the field manufactured before this part became standard equipment. Insofar as drawbar configuration goes, this change brought H1030R swinging drawbar in to replace H675R.

The model "H" was not in production when this standard was implemented because the tractor factory was in wartime production. Accordingly, the first "H" seeing these changes was H-47796, the start of the 1945 model year. That tractor was built in the fall of 1944, after the October 13, 1944 production start up.

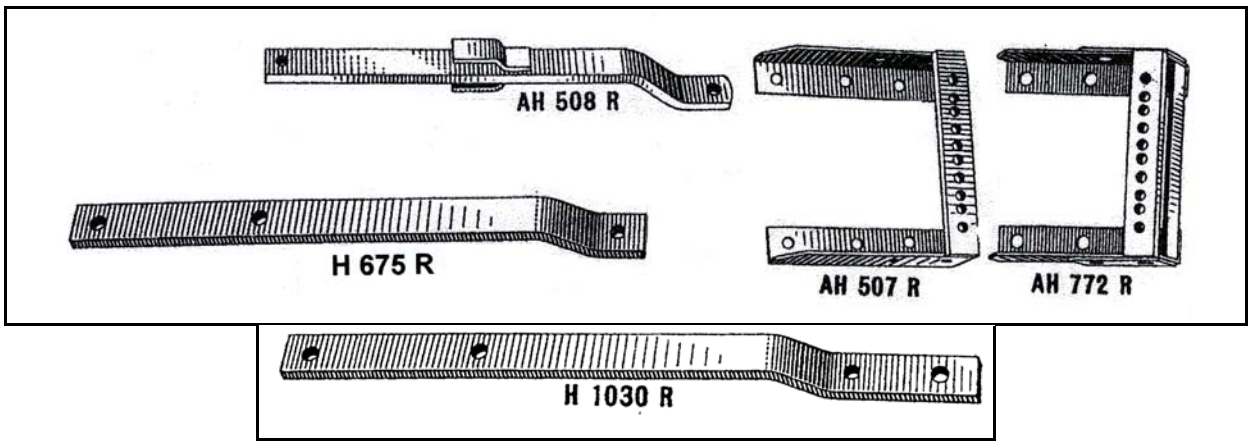


Figure 607. JD "H" Drawbars

In accordance with this change, drawbar H1030R was introduced which replaced the then-current **H675R**. H675R is similar to H1030R in that it had an offset bend that permitted high and low drawbar positions by inverting the drawbar. H675R also featured two pivot pin holes to facilitate drawbar extension or retraction. However, H675R had only one hitch pin hole to attach implements, whereas H1030R has two holes (see figure 607). H1030R retrofits tractors back to S/N H-7186, and thus H675R has disappeared from today's parts references as a direct result. Deere & Co. saw no reason to retain H675R as a separate part. However, going by serial number applications, it appears the following approximate quantities of drawbars are "out there": 6,185 of AH508R, 40,418 of H675R, and 13,321 of H1030R. So, the "extinct" H675R drawbar is by far the most frequent drawbar you are likely to see.

The Drawbar Today -- Drawbar assemblies usually will have cracks in them or be missing something. Many were damaged in some way. "Get-by" repairs were made, and not followed up on. A fault recently found was a broken H105R drawbar pivot pin. By design, the lower end of this pin is a press fit into the AH509R support bracket assembly. It then passes through the swinging drawbar and inserts up into a boss in the main case. The break in the pin was at its interface with the AH509R bracket. The broken-off part (smaller end) was found still imbedded in the support bracket. The main case boss was enlarged as a direct result of continued use after the break occurred. To simply renew the H105R pin as designed would have resulted in a repeat failure because of the enlargement. A new way had to be found using a "clevis concept".

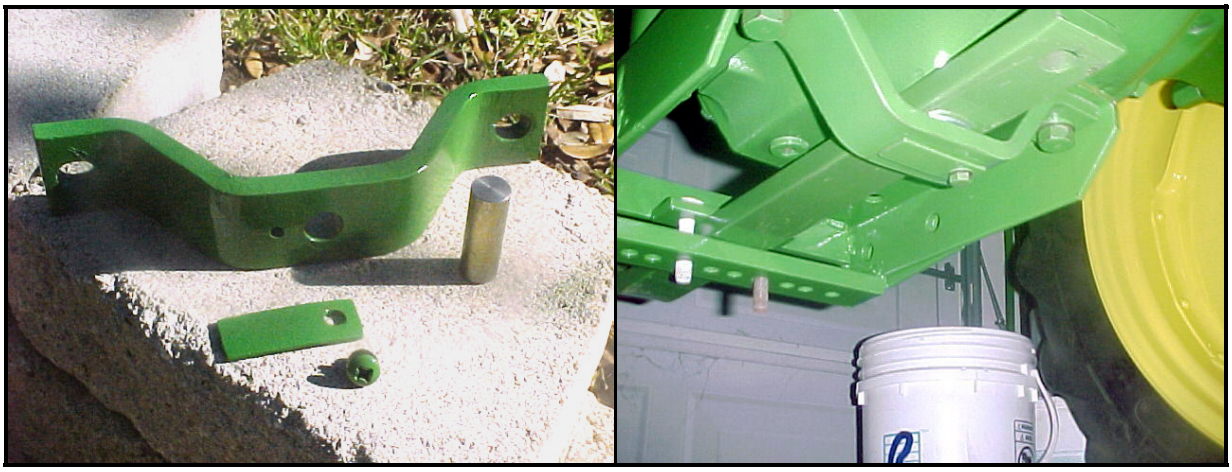


Figure 608 (A&B). A- AH509R support drilled to 3/4 inch, a new pin to replace H105R, and a clip with short machine screw to hold pin in position. B - Shown here is the final outcome of the drawbar with new work-around installed.

Work Around -- One solution is to make a 3/4 inch diameter pivot pin which is 2-1/32 inches long from a grade 8 hardness bolt or rod. Chamfer one end ever-so-slightly at 45 degrees to fit into the boss in tractor's main casting. Next, bore the 5/8 inch diameter hole in the AH509R bracket to 3/4 inch, just slightly larger than an interference fit for the new pin. You now basically have a clevis situation. The one remaining issue is gravity. To retain this pin in position, modify the bracket for a retaining clip. At approximately one-half inch from the 3/4 inch hole just bored, drill and tap for a 5/16-18 cap screw. Make a small retaining clip from a 1/8 inch thick piece of steel, one inch wide. The clip should be 2-1/2 inches long with a 5/16 inch diameter hole bored in its center, 1/2 inch from one end. The clip will hold the new pivot pin in place using a 5/16 x 5/8 inch cap screw and lock washer. This new design also allows the H1030R swinging drawbar stem to be removed without unbolting the AH509R support bracket.

Main Case -- Carefully inspect the tractor's underside (belly). A really thorough cleaning will be done somewhere along the line to prepare for painting. This is the ideal time to look for cracks, and for missing pieces. Reference, Appendix 7. For PTO tractors, inspect the cast-in bearing holding collar for the inner power shaft bearing. Examine all studs and tapped holes for thread quality. All these should be chased at some point prior to buildup. Be especially critical of the tapped and threaded mounting holes for the

Figure 609 (A&B). Note 3/4 inch flat washer - installed along with swinging drawbar to reduce play. At right, we have a main case just back from vat-clean, plus after a quick coat of primer to prevent rust.

drawbar. If you determine a need for machine work, it is a whole lot easier to work a bare main case than a built up tractor! Drill and tap to the next higher size is recommended over helicoils when repairing worn or stripped drawbar mounting holes. An ordinary engine hoist lifts a main case, and is handy for loading it into your truck.

JD "H" Power Lift System

(Operators Manual, page 26)

Live Power Lift System -- When it comes to hydraulic power lift, the JD "H" tractor was a standout above other tractors of the era. With the engine running, this unit operates whether the tractor is in motion or standing still, clutch engaged or not engaged. The power-lift pump attaches to the governor housing and is driven by the governor shaft. Therefore, an operating PTO is not needed for hydraulic lift operation as is true for other JD tractors of the day. The power-lift pump is connected to a single-action lifting cylinder by means of a flexible hose, which makes it possible to mount the lifting cylinder in different positions on the tractor for the various equipment items. Hydraulic pressure raises an implement. Ensure lift-assisting springs are in place and adjusted, and have engine at full throttle during operation. Gravity is the down force. The system provides a "cushioned drop" and this drop rate is adjustable for both light and heavy working equipment, which is common for farm implementation.

Power Lift Cylinder -- PC304, page 44, upper figure. The lift cylinder is made of cast-iron with a 2-1/4 inch bore and total travel of 5-5/8 inches. At design operating pressure, cylinder force is roughly 2200 pounds. Arrows on the cylinder indicate "this side up", this orientation needed so that the built-in oil recovery mechanism (oil-return check ball and plunger) can collect and return oil that passes the piston's cupped washer. Oil leakage from the cylinder is usually caused by foreign matter under the oil-return check ball at the head end of the piston. If the ball is unable to seat fully, oil flows to the skirt end of the piston, and on out of the cylinder.

When oil leaks are noticed, remove the cylinder, take out the return check and remove the debris. When putting the cylinder back together, ensure the small drilled hole in the piston retainer is aligned with the return check. The piston rod must be installed so that when the outer cylinder is placed over it, the set screw and nut can be tightened securely against the flat side of the piston rod.

Duplex Control Valve -- PC304, page 44, lower figure. With the advent of integrally-mounted two-way plows requiring two separate power lift cylinders, some means had to be provided to control each cylinder individually. The duplex control valve was developed for this purpose, and it was merely a basic switching valve. The duplex control valve mounted directly to the outlet port of the power lift unit, and the other end of the valve accepted two individual hose and cylinder assemblies. Turning the control handle of the duplex control valve to the left allowed the left cylinder to respond to the power lift unit while the right cylinder was sealed off and remained motionless. Conversely, turning the control handle to the right caused the right cylinder to respond and the left to remain motionless. Simultaneous response of both cylinders was not possible.

Power Lift Fluid -- Use the same oil as in the crankcase. You should maintain the oil level as shown in your Operator's Manual, whether or not the unit is being used. Oil is maintained in the "always running" unit to protect the pump. Always place any implement in the "down" position before checking or adding oil. Capacity is roughly two US Quarts.

Concept of operation -- Operating valves direct the flow of oil to and from the remote cylinder. Oil is pumped OUT of the reservoir to the cylinder to RAISE an implement, and is returned from cylinder to reservoir when the implement is lowered. Again -- when checking oil level in the valve housing, make this observation with the implement LOWERED.

Having the control lever in neutral position sets valves to allow free flow of oil through the pump and returning to the reservoir.

To RAISE an implement, the control lever is pushed down as far as it will go (down closes the by-pass valve), and then raised. At the end of the raise operation, the check valve closes to keep implement raised by preventing oil from returning to the reservoir. When the cylinder is maxed out, the pressure relief valve overflows causing the unloading system to trip the control valve back to neutral.

To LOWER an implement, the control level is moved to the down position, forcing the check valve to open which permits oil to return from cylinder to reservoir. The lowering rate of an implement can be regulated by backing the valve control OUT to lower faster, and IN to reduce lowering rate.

System operating pressure is designed at 555 PSI with a cracking pressure of from 675 to 720 PSI. The oil flow rate is not written, but known to be fairly low.

Troubleshooting (See Appendix 18) and for Lift Unit Overhaul (See Appendix 17) -- See also the JD-H Service Guide -- Get every moving part to move freely, polish every valve and smooth surface, replace every spring and seal, and ensure total cleanliness at every step. Being free of foreign matter is an absolute key to success in the JD "H" Power Lift System.

For deeply pitted valve seats, you may need to grind deeper to obtain a good seat. But, grind ONLY as far as you must. Then the hydraulic system should work as designed. Wash all parts thoroughly with solvent. Blow out all passages. Inspect valve housing for cracks, holes, or damage. Repair as needed. Pre-oil parts as they are reinstalled. Inspect hole at lower end of by-pass valve passage to be sure it is open. Check freedom of movement of by-pass valve in its passage. The same techniques are employed with the duplex control valve and lift cylinder.

For the gear-driven pump, clean parts with solvent. Inspect for excessive wear, scoring, etc. Inspect pump body for sign of "freeze cracking" - renew as needed. Renew seal (sealing lip goes toward pump gear), evaluate gear bushing and gears, and inspect governor shaft bearing for a possible renew. One possible cause for oil leaving the hydraulic unit reservoir and flowing into the crankcase is a bad pump seal. Pre-oil parts during reassembly.

A Collection of Operating Tips

Mounting Master PTO Shield --- See your Parts Catalog, pages 28 and 29. The (AH821R) shield (item 50 on page 28) bolts to the AH608R platform (item 13 on page 29) in the process. The shield is also fastened to the rear housing cast iron (H599R) cover, item 34 on page 28. The flipper guard is raised and fits into a slotted area in the master shield to keep it out of the way. Fastening the master shield in place seems easy enough to do until you realize that, because the flipper guard is in the way, you aren't able to reach both ends of the nut and bolt fastening between the master shield and the platform if the platform is already mounted. The solution is to mount the master shield to the platform first, and then install the resultant combination onto the tractor. You still have to fit the flipper guard up into the overhead slot, but that is not hard. NOTE: For tractors lacking a flipper guard, platform removal IS NOT necessary!

New Life for the 3-way Fuel Cock -- Your best chance to save this precious piece is to gently but thoroughly polish (lap it down with valve grind compound) to make the valve surface nice and smooth and position it into its seat as you would lap an engine valve into its seat. Then renew the D2122R cork washer. At present, Deere & Co. has this assembly priced over $150.00. This is incentive enough to restore it. Do not use a drill or any powered device to turn the valve inside its chamber. By so doing, if a speck of grit gets into the valve chamber along with the valve, a score will be cut all the way around, and

usually render the cock useless! An O-Ring solution has been proposed, and may be reviewed at www.jdhpubs.com.

Restoring Springs -- For springs that do their work by stretching, make a small jig out of 2 x 4 wood stock, the distance across which is slightly greater than your normally stretched spring(s). Then, on opposite sides, install some deck screws, or nails! Using ordinary utility wire (16 to 18 gauge for instance), connect an end to one side, and then stretch (don't over-stretch) the spring as you connect the

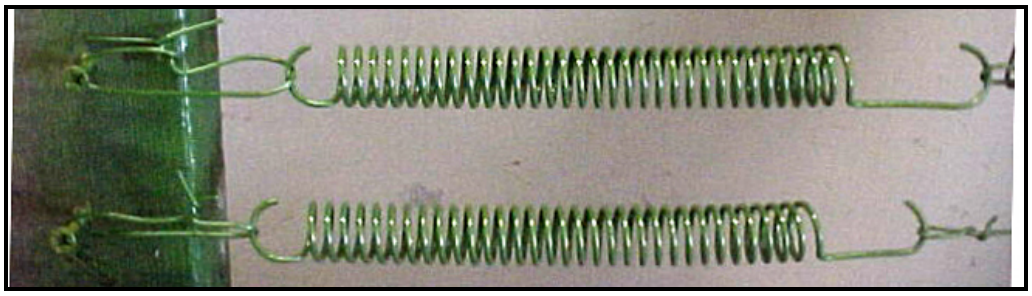


Figure 610. Dealing with springs that do their work by stretching.

other end, also with utility wire. Having made the jig large enough, one can stretch several springs. The now-stretched spring(s) can be sand blasted, wire-brushed, spray primed and painted. You can shoot right through it!

Threaded plugs and fittings -- During the build-up of your tractor, you will have many threaded fasteners, plugs and/or fittings to secure. Zero leaks is the only acceptable outcome! For plugs and fittings, it is risky to draw them up tight with hopes of producing leak-free operation. Apply **plumber's pipe dope** or **Teflon tape** to the threaded regions of plugs and fittings. When securing the fitting into its tapped receptacle, go in only as far as you must; avoid having to "back-up". Be deliberate on your first pass. Remove any residue from the fitting once it is secured into position.

Anti-Seize Thread Lube -- For all bolts (includes studs) being installed into a casting or helicoil, apply an anti-seize compound (Locktite or Nev-R-Seize) to the threaded region before installation. Torque values applied during final assembly are reliant upon clean lubricated threads to be accurate. See Appendix 2, Standard Torque Values.

More on your Journal -- Whether or not your written word journal uses pictures too, there may come a time when you will regret not having recorded doing some small thing. As you go along, maintain a **Chronicle to the Journal**, first mentioned in Chapter One. The primary purpose of this document is to be a personal reminder to yourself of those little things you do that might later loom large if (by chance) not done.

Case in Point -- During the total teardown and then build back up of Little Johnny (H-42820), I disassembled, cleaned and reassembled the oil pump. This tractor had not been run for 12 years, and the sludge simply needed to be removed. Besides, both of the two oil pump gaskets were leaking which left me little choice but to remove and reinstall the pump with new gaskets.

My problem of poor memory came home to roost on January 13, 2004, some two or three months later. The first engine run up was less than a success. Two issues surfaced; one was the carburetor and the other was substantial gear noise in the governor! I think the noise problem surprised me much more than the carburetor because I did not feel right with the carburetor from the beginning. I rode along with it for the time being because a carburetor is easy enough to deal with; it was not a "buried" problem!

What was causing the noise? Every bearing in the governor and fan shaft S/A's had been replaced. A special integration procedure was performed to mate the governor assembly to the fan shaft assembly prior to installation onto the tractor. My hunt for the cause began. I was afraid that the oiling line up to the governor from the oil pump was not carrying oil to the gears. I was pretty sure I tested that oil path while the tractor was apart. But I didn't write it down! I would have to tear down to the extent needed to test that hypothesis unless there was a way to determine that oiling WAS taking place and that some other cause was found. There was one other more plausible cause; insufficient space between those gears (fan backlash insufficient). As it turned out, this indeed was the cause, and added gaskets became the solution. I was relieved. The morale here is (a) be 100% in your inspections prior to and during assembly, and (2) make a note (journal) that various passages were cleaned and/or found to be open and clear!

Making Gaskets --- As discussed in Tooling, a hole-punch set ranging from 1/8 to 1/2 inch is needed for making bolt holes in gaskets. You should purchase the engine overhaul gasket set, most all cork gaskets, and all the extra large gaskets. The radiator core-to-tank gaskets are examples of large gaskets. Making gaskets may not be for you, but many are simple and easy to make. See Appendix 4.

Paper gaskets are described in JD literature as thin, medium and thick. These translate to 1/64, 1/32, and 3/64 inch thick respectively. Generally, you will be successful making most of your paper gaskets from the 1/32 inch or medium-thickness material. The thick gaskets (3/64 inch) will generally be used between heavy cast pieces such as between main bearing housings and the main case. **CAUTION**: Be mindful of areas where gasket thickness can be important such as in the oil pump where a **B246R** gasket that is too thick may result in lowered oil pressure because oil could "slip by" the pumping gears. Paper gasket material of each thickness, and cork stock 1/16 and 1/8 inch thick are available at most auto parts outlets.

Studs – Definition -- A stud is more than a section of all-thread! Some studs have special construction in that the threads on each end are NOT EQUAL. This is especially true for cylinder head studs. There is an "insert end" and a "nutted end". The insert end will generally be cut square and have a thread slightly over-sized, tapered a bit, and is designed for a bit of an "interference fit" when installed into the casting's tapped hole. The nutted end will be rounded with threads that are uniformly cut. **The test:** A nut on the nutted end will travel all the way with equal resistance, but will seize half-way on the insert end.

Depth of Studs into Castings -- When installing studs into one casting in order to attach another casting to the first, observe that general guidance for studs is to turn studs into first casting (example into head for a manifold) a distance 1.50 times its diameter -- STANDARD HANDBOOK FOR MECHANICAL ENGINEERS" Seventh Edition). Be sure that the blunt end is the end turned into the head. Apply anti-seize compound to studs.

Lower Cost Studs, Caution. – Money can be saved by using ASTM A193 Grade B7 (Grade B7) Threaded Rod for replacement studs in many applications this tractor, but ARE NOT recommended for studs connecting the head to the block. For head bolts, you should "bite the bullet" and purchase new when replacements are needed. Stud lengths involved the cylinder head are quite critical in most JD tractors, and the length is generally provided in the Parts Catalog. Take heed! For the JD "H" tractor, the cylinder head stud is B355R (9/16 x 5-1/4 inches), and can be found in many fastener outlets such McMaster-Carr or Fastenal, Inc. If all you can buy is 9/16 x 5-1/2 inches then buy it and cut off a quarter inch, cutting the quarter inch off the nutted end! The oil lead stud, on the other hand, is one of those special ones (H109R) and must be purchased from a suitable source, either new or used Grade B7 threaded rod has grade 5+ hardness. Be sure to purchase 2H (grade 5) hex nuts to go with the studs if nuts are needed; both available at most fastener outlet stores. Generally speaking, grade 5 fasteners are suitable for use throughout the "H" John Deere. In every case where you employ Grade B7 Threaded Rod for making studs, be certain to cut to the length specified in PC304 Parts catalog.

New Leather Seals and Boots -- New leather seals and boots should be "oil-treated" with a leather-treatment oil prior to installation. Massage oil into leather seals and boots much as you would oil into the air cleaner sponge for a small lawn mower engine. Never install them dry. This note applies also to felts.

Too Much Hardener --- When using shop compounds calling for hardener such as filler primer, glazing mix, glazing putty or cream, BONDO ™ and/or BONDO CREAM™, be careful not to add too much hardener. Excessive hardener accelerates the chemical process more than intended and may lead to holes and/or cracks in the finished product.

Missing Lines and Conduits --- For missing lines such as radiator overflow tube or the oil pressure gauge line, be creative. Be a problem solver. Fabricate replacements from locally available materials. For radiator overflow, one can build replacement of 3/8 inch copper tubing, from 1/8 inch NPT pipe using a 90-degree elbow, or from steel brake line stock. To replace a missing oil pressure line, and achieve a beautiful outcome, fetch also some 1/8 inch diameter copper tubing to use as a pattern, establishing both shape and length. Then cut and form the actual tubing material (3/16 inch) to length and form per the pattern. Where a bend is called for, bend the new copper line around something like an empty can or coke bottle of appropriate diameter. Don't rush little jobs like this. Enjoy them!

Mounting Tires on Restored (painted) Wheels -- It is recommended that as much time as is possible be allowed between painting of rims (wheels) and mounting of tires. At least a couple weeks during which daytime temperature exceeds 75 degrees (F). When mounting the tires, some nicks and marks will result. The technique is to deflate the tire, put spacers between the mounted tire and rim, and apply touch up paint. Be sure spacers are large enough to prevent being dropped inside of the tire!

Frequently Asked Questions

1. What causes the engine to sling oil on the flywheel side? The design here is neat in that oil is furnished under pressure to the main bearings, and like any other liquid will have a propensity to seek a "lower level". Immediately outside the main bearing housing is a small piece called a "flywheel spacer". It is more than that. It is called the "oil slinger" by many in the "community". Centrifugal force slings escaping oil to the bearing housing, which channels the oil back to the crankcase. Three possible reasons for oil being cast from the flywheel side are a defective cork seal in the slinger, the flywheel installed such that its drive pin isn't engaging the slinger (a drive pin in the flywheel turns the slinger with the shaft thus no wear on the oil seal), or the oil return path down through the main bearing housing is clogged. See question # 14 for oil sling from the belt pulley side.

2. What is the fix for oil leaking from the interface between the block and main case? The paper gasket between the block and main case is not that substantial. Over the years, bolts holding the block to the main case work loose. Try to simply draw those fasteners up tight and hope it helps. Failing that, the fix is to renew that gasket which means (at minimum) removing the cylinder head and the items thereto attached, and also moving the cylinder block with its pistons far enough forward so as to do the cleaning and install a new gasket. Use gasket sealer with the gasket. Some have suggested to simply loosen the block fasteners, move the block forward a tad, insert some RTV, then draw it back. This is not a great idea! The tappet oiling line is hard-connected between the block and oil pump. Moving the block like this will open a leak in the oil pump output, and you will lose oil pressure! Remember -- it is forced oil flow to this JD "H" engine that provides longer engine life.

3. Hard starting is a major issue with many owners. Three issues come to mind here: compression, ignition and a fuel-air mix. Take any one of these three away and the engine will not start. Don’t overlook

clogged air-in to the engine! See **compression testing** (next item), and the diagnostic sections of Chapters 7 and 8, **Electrical Systems** and **Carburetors** for a complete reading on these issues.

4. What should a compression meter read on the "H" tractor -- being hand cranked? The best testing conditions are with a hot engine. A reading of 80 PSI is tops for the JD "H" Tractor. When hand cranking a new rebuilt engine, I was able to achieve this reading on each side. You need to have throttle and choke wide open, both plugs removed, and *short plug wires to chassis ground*. There is to be no resistance to air flowing into the engine, and surely while testing one side, you don't want compression on the other fighting against you. Crank the engine over and over at least a half dozen compression strokes before reading the result. Read, record and then "burp" your compression gauge and do it all over again. Run three series on the cylinder before arriving at what is the actual result. You should obtain two readings that are very close. Repeat the series pattern until you do! The JD "H" will start and run fairly well with compression as low as 40 PSI. A more germane issue is that the readings be close to each other; say within 10%. A good reading (50 - 70 PSI) on one side and a near-zero reading on the other reveals a firm and real hardware failure.

Poor Compression -- Poor compression can be attributed to a leaking cylinder head gasket, leaky valves, tappet levers set too tight, stuck or worn piston rings, or worn pistons and cylinders. To test for rings squirt some oil into each cylinder, and if the readings then improve significantly, you have worn rings. For valves, a helper can listen as you bring each cylinder up on its compression stroke. Listen for a hissing-like sound in the carburetor to indicate a leaking intake valve; listen for a similar sound at the exhaust stack (leaking exhaust valve); and listen also at the crankcase breather for leaking (indicates leaking past the rings). Some leaking or "hissing" heard at the crankcase is normal.

No Compression -- This condition is most always a direct result of a valve stuck open, or even a broken valve. A first check, however, is to ensure the tappet (rocker arm) is operable and set so that valves are permitted to close!

5. Should I use a "kill switch" to stop the engine? Your operator's manual will flatly say, "do not stop the engine by shorting the magneto". And before this statement is a reference to using low cost fuels, this coming in the paragraph that tells you to shut off the fuel supply and allow the engine to stop -- leaving the combustion chambers dry and free of unburned fuel. Using the recommended shut-off procedure for operation with gasoline will result in fewer starting problems and improved lubrication of the engine when first started. For some operators, however, having a switch to short the ignition is a **SAFETY** switch to prevent injury. Without supervision, unqualified persons (such as children) have been known to take the tractor for a joy ride. Very young people DO have what it takes to start the JD "H" tractor!

6. How to deal with cleaned up axle spines so they don't freeze up again? The basic concept is to keep weather off the axle shaft! Several options exist. In the early years, farmers tied burlap rags, with some oil added, around the exposed axle sections with baling wire. Burlap was plentiful in those days because burlap bags were used for all manner of feeds bought for cattle. This same solution still works well today. There are many special coatings on the market. Two such coatings are Graphite Lube (TY25797), and Blitz Black (TY25631), both from your JD Dealer. Blitz Black dries quickly and can be thinly applied. The main caution is to avoid a build-up that will make the wheel hub impossible to move. If you do apply a paint coating, allow ample cure time before clamping a wheel hub down onto it. Otherwise you will have a new problem.

7. What is distillate, and what combination of current fuel types will "equal" distillate? What mix (if any) will make this little tractor sound, smell and perform as it did when burning distillate? Distillate was a by-product of an oil refining process now forever changed -- the change driven by increased demand for specific fuels to support the World War II effort. The need was for gasoline and lots of it!

Distillate was a left-over from crude once the popular fuel forms distilled out, these coming out of the mix in order of volatility e.g., methane, butane, propane, and so on. The crude is a mix of liquid hydrocarbon chains, and when heated, the liquids convert into gases, the lighter ones boiling off first, and heavier ones thereafter such as gasoline and kerosene. At some point down in the process, a mix of heavy hydrocarbons remained -- this mix was referred to as distillate. With demand for specific fuels for WW2, the distillation process was abandoned (no more distillate), and in its place the "cracking" process wherein all of the hydrocarbon chains in the crude are split out and then recombined into the hydrocarbon chains needed to produce specific fuels such as gasoline, kerosene and diesel. As for what mix of today's fuels will replicate performance and smell of those old days, there seems to be wide variation by folks who have both knowledge and experience. A summary follows. Letting G = Gasoline, K = Kerosene, D = Diesel, and FO = Fuel Oil, and with numbers for percentages, here are some combinations that do work: (50G + 40K + 10D), (25G + 75D), (33G + 67D), (50G + 50D), and finally we have (60G + 40FO). The last combination was called "power fuel". Remember, engine temperature must remain above 180 degrees to burn these fuel combinations. If not, low power and plug fouling result.

8. What is an over-running coupler? Do I need one to use the PTO shaft? The over-running coupler is basically a sophisticated ratchet. And yes, it needs to be greased now and then. When the PTO shaft is being powered, there is a one-for-one transfer of rotating power transmitted from tractor to implement. And if, for some reason, the tractor's power shaft rotation is halted, the over-running coupler will act as a ratchet allowing the driven implement to wind down on its own even though the tractor's power shaft is stopped. See Figure 909 (end of Chapter 9) for a picture of a mounted over-running coupler.

Why would a tractor's power shaft suddenly stop? In most all farm tractors before the early 50's, the power shaft was manually shifted into or out of gear, but only when the tractor's main clutch was disengaged which is the same condition needed to shift drive gears. In other words, the power shaft is "hard-connected" to the transmission's sliding gear shaft; the first transmission shaft, the one that is clutch-driven from the tractor's engine! If you have the tractor in a forward gear and also the power shaft in gear, tractor motion and power shaft rotation are directly connected through the sliding gear shaft of the transmission. Without the ratchet action of an over-running coupler, the act of disengaging the clutch will not stop the tractor. The driving source is the **inertia stored in** the power-driven implement. This "mass in motion" is driving the sliding gear shaft thru the power shaft, and if the tractor's gearshift is still in a forward gear, the tractor will be driven! Many a neighbor's fence was run down in this way when you intended to stop a couple of feet away from it.

Back in the 1950's one didn't hear of an over-running coupler because it was second nature to "pop" the tractor out of gear just as you pushed in the clutch if you didn't want to plug the combine, or choke down the baler.

9. Is Sand Blasting a procedure for the whole "H" Tractor? No! This tractor is one step up from being a garden tractor in terms of being able to break it down and deal with the small parts. I recommend sand blast of selected components. Wheels, the seat parts and the upper and lower radiator tanks top this list. If I do send a collection of items to sand blast, I include a "picture inventory" as part of a statement of work; the statement of work is to make sure you have understanding with the sand blast man as to what will be done, and the picture inventory (of course) is to make sure you get all the parts back! The main case, once emptied, can go to a "vat clean" process that doesn't leave you a case full of the Sahara Desert! For commentary on sand blasting of sheet metal parts, see Chapter 2.

10. Where can I get oil filter cartridge replacements? The answer is "everywhere"! The Deere part number listed in the parts catalog for the filter element, AH812R, is no longer valid. It has been superceded by **AH 1082R**. Further, part number AH1111T is invalid as well. See "Oil Filters" in Chapter 3 for a partial listing of replacements by brand and part number.

11. What about Babbitt Bearings, do I need them, and to whom must I turn for help? First some history: By the beginning of the 19th century, railroading drove a need for better bearings to carry heavy loads over a long distance. Along comes Isaac Babbitt, granted an 1839 patent for what would become the standard in bearings for a very long time. The concept is soft metal linings contained in harder and stronger shells. The soft metal against a hard backing is able to retain much plasticity permitting the bearing to adjust itself to the contour of the shaft and to slight variations in alignment. Lack of this feature resulted in many a "hot box" in the early railroading days.

Basic materials include copper, lead and tin with additions of various elements to change characteristics. Arsenic added for hardening, antimony to impart hardness and smoothness, Bismuth to lower the melting point of alloys and to impart hardness, and cadmium sometimes used to harden copper. The nature of the application determined the ratios of copper, lead and tin, from a tin-based alloy for heavy service to a lead-based alloy for light service. Additive percentages and/or ratios are varied with the grade of service as well.

A babbitted bearing is essentially hand-made. It's a result of determined preparation of the bearing shell and other "forming" pieces, and of the raw materials; then the act of pouring the molten Babbitt into the mold as formed.

There is much more handiwork to be done once cool-down is achieved in order to make the finished product serviceable. Without experience or an experienced hand to guide you, attempting to remanufacture your tractor's babbitted bearings is not for the average Joe. The successful artisan will have both knowledge and skill. On the other hand, if an "old hand" is there to guide you, the process can be a rewarding one indeed.

Fortunately for most of us, both replacements for babbitted items, and providers of babbitting services are readily available. How do you connect with them? Search through Green and Two Cylinder Magazines. Your regular JD parts source and/or Dealer will usually know of reliable places to shop, and Internet users can use the tractor discussion forums.

12. What are possible causes for sudden lower oil pressure, or for none at all? A distorted oil filter body is one cause. Distortion is usually the result of excessive torque applied to the lower cover nut. See photograph on page 162. "Normal" tightening is sufficient. Do not over-tighten it! If leaks persist, renew the rubber gasket. A second cause could be that one of the oil lines leading from the pump wasn't fully installed during reassembly. A third likely cause is that the home-made pump gasket (in substitution for B246R) is too thick allowing oil to "slip by" the pumping gears. See expanded discussion in Appendix 14.

13. How do I read my tractor's "smoke signals"? When diagnosing engine problems, black smoke indicates too much fuel going into the engine or engine air input is restricted, and blue smoke tells you the engine is burning oil. For blue smoke -- if this smoke is coming during a load, suspect worn rings, but if it smokes under partial throttle or at idle, suspect worn valve guides.

14. What causes the engine to sling oil on the pulley side? This oil IS NOT from the crankcase, but from the main case. Oil traveling the reduction gear lubricates both bearings of the sliding gear shaft, the R.H. camshaft bearing and the belt pulley bushing, ref – **Transmission Lubrication System, Ch 4**. Oil run-off from the R.H. camshaft bearing and belt pulley bushing returns to the main case through a small path beneath the belt pulley. The two main causes for pulley-side oil sling are either a plugged return path, or differential oil level is too high. Water entering the main case will result in high oil levels in the main case. High oil level in the main case may also manifest itself in oil leaking from the rear axles. Annual checks to ensure rear axle housing **weep holes** are open will help the operator in early detection of oil leakage from main case into the axle housings.

Equipment for Model "H" Tractor

H-200 Series Two-Row Hand-Lift Cultivators:

H-202 -- Front section: 8 spring trip shanks; rear section: 3 spring trip shanks. Adjustable for 34-to-42-inch rows.

H-204 -- Front section: 8 double spring teeth; rear section: 3 double spring teeth. Adjustable for 34-to-42-inch rows.

H-208 -- Front section: 8 spring trip shanks; rear section: 6 spring teeth, adjustable for 34-to-42-inch rows.

H-214 -- Front section: 11 spring teeth; rear section 6 spring teeth. Adjustable from 28-to-42-inch rows.

H-216 -- Front section: 11 spring trip shanks; rear section: 6 light spring trip shanks. Adjustable for 28-to-42-inch rows.

H-218 -- Front section: 4 spring trip shanks next to rows, also 7 spring teeth; rear section: 6 spring teeth. Adjustable for 28-to-42-inch rows.

Attachments for use with H-200 Series Cultivators:

PH-201 runner-type planting equipment, with knife coverer. Adjustable for 34-to-42-inch rows.

FH-202 fertilizer attachment, for use with PH-201 planting equipment. Adjustable for 34-to-42-inch rows.

H-10 Single-Row Middlebreaker: Hand-lift; 14-nch bottom.

H-20 Series Two-Row Middlebreaker and Lister: Hand-lift; 12-inch bottoms. Adjustable for 36-to-42-inch rows. Specific serial numbered equipments were:

H-21 -- Middlebreaker or listing plow
H-24 -- With corn cans and shovel coverers.
H-25 -- With corn cans and disk coverers.

H-1 Single-bottom, Right-hand Plow: Hand-lift. 12-. 14-, or 16-inch bottom. Then there is an H-5 right-hand plow and H-10 two-way plow, both operated by power lift.

John Deere H-620 Six-Row Beet and Bean cultivator: Hand-lift. Cultivates maximum of six 22-inch rows or four 34-inch rows.

In addition to the regular drawbar on the Model "H" Tractor, which can be used for pulling a wide variety to implements, special tractor hitches were available to adapt the new Model "H" to a number of JD horse-drawn and power-driven implements.

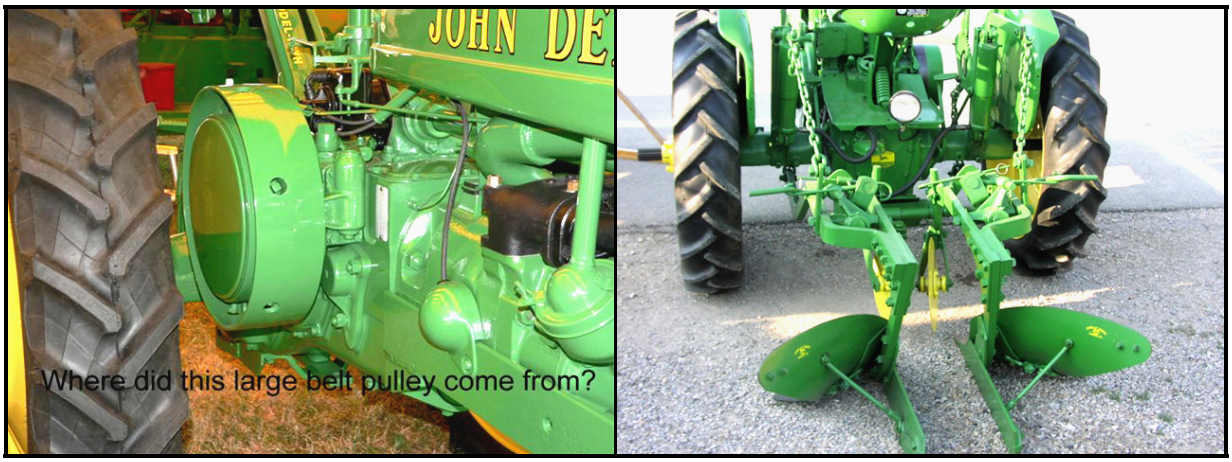
A Partial List of JD "H" Fasteners with JD Part Numbers Assigned

14H261R	Nut-hex, coarse thread, 9/16"
14H383R	Nut-hex, coarse thread, 3/8"
14H392R	Nut-hex, coarse thread, 1/2"
14H404R	Nut-hex, coarse thread, 3/4"
14H732R	Jam nut, coarse thread, 3/8"
14H785R	Nut-square, coarse thread, 5/16"
19H98R	5/16 1/2" Fillister Head Cap Screw
19H99R	5/16 x 9/16" HHCS (Hex Head Cap Screw)
19H199R	3/8 x 5/8" HHCS
19H203R	3/8 x 3/4" HHCS
19H211R	3/8 x 1" HHCS Domed (19H 218R)
19H332R	7/16 x 1-1/4" HHCS
19H474R	1/2 x 1-7/8" HHCS
19H1112H	5/16 x 3/4" HHCS
19H1335R	5/8 x 1-1/2" HHCS
19H1356R	5/8 x 1-3/4" HHCS
19H1475R	5/8 x 3-1/2" HHCS, Wheel hub clamp, H and HN (Sub for H222R, R21028R)
21H597R	1/4-20 x 1/2" Slotted round head machine screw
21H1002R	5/16 x 1/2" Slotted truss head machine screw, sub for A2050R
22H42T	5/16 x 3/4" Set screw, square head, dog point
22H87R	3/8 x 1-3/8" set screw, square head, conical point
22H119R	7/16 x 1-1/2" set screw, square head, cup point
22H139R	7/16 x 2-3/4" set screw, square head, cup point
A119R	3/8 x 1-3/8" Stud
A310R	7/16 x 1-1/4" HHCS, drilled
A487R	3/8 x 1" HHCS, Special head
A2191R	5/16-18 Square Nut
A3232R	5/16 x 1/2", RHPHMS (Round Head Phillips Head Machine Screw), sub for A2189R
A5292R	5/8 x 2-1/4" stud
B1190R	3/4 x 4" Wheel Hub Clamp, HNH, HWH
B1353R	1/2 x 1-3/4" Stud
C834R	5/16 x 9/16" HHCS, drilled
D916R	3/8 x 3/4" HHCS, drilled
D3293R	5/16 x 1/2" RHPHMS with square nut
H295R	7/16 7-7/8" Stud
H313R	5/16 x 3/4" HHCS, Drilled
H352R	3/8 x 3-1/2" HHCS, drilled
H673R	5/16 x 1" HHCS, Drilled
H830R	3/8 x 2-1/2" HHCS, Drilled
H831R	3/8 x 3" HHCS
H832R	3/8 x 2-3/4" HHCS
H925R	7/16 x 1-3/8" HHCS
H959R	1/2 x 2" HHCS, Drilled, special length thread
H1085R	5/16 x 3/4" RHPHMS (sub for H488R)
H1086R	5/16 x 1-1/4" RHPHMS with square nut (sub for H489R, H1109R, and 14H785R)
JD16R	9/16-18 x 1-1/2, Right hand thread, Rear Wheel bolt
R2622R	7/16 x 4-3/8" Manifold Stud

Here & There

Front wheel without reinforcing ribs (left), and with ribs (right), Mid-1941 Change

Three-hole seat used on late "H" tractors (left), and distorted oil filter body caused by excessive torque on oil filter cap nut (right)



The very rare over-pulley (left), and H-10 plow (right)

The Electrical System

Chapter 7

For years, the magneto was the only electrical type device on farm tractors. Most folks knew just enough about them to avoid being shocked when its impulse sounded! Then came practical systems of storing enough electrical energy to drive a starter for the engine. For this feature, of course, the tractor needed energy stored in a battery, and a generator to recharge the battery after starting the engine. Tractor lighting using power from a generator had been in use for years before lead-acid storage batteries and electric starters come into common use. However, by the time such electrical systems were being demanded for farm tractors, they had become "old hat" in the automotive world making it natural that current automotive systems would be "lifted" and adapted to tractor use. This brought with it 6 Volt DC systems using positive ground. Questions such as why use the positive terminal of the battery as the common return (ground) and a variety of responses/reasons abound. The result is that **Typical 6 Volt DC System (See Fig 701)** with positive ground, the norm for most farm tractors up through the early 1950's.

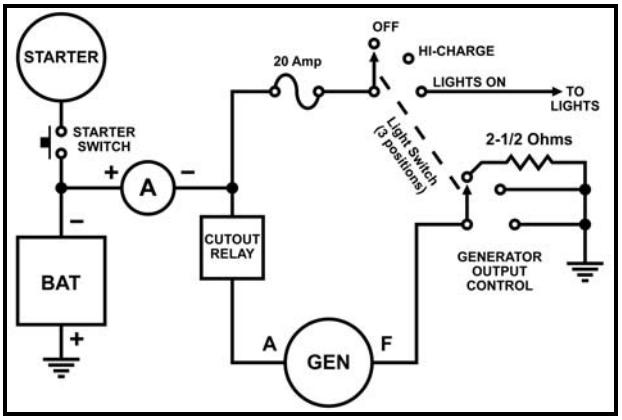


Figure 701. Typical John Deere 6-Volt Externally Grounded System

It is a tribute to the basic integrity of these older systems that they remained part of the design package of farm tractors for so many years. While coil and distributor ignition came into the lettered series toward end of production, the "H" tractor employed the magneto as its ignition system from the first tractor to the last with serial number 61116 which rolled out the door in early February 1947, and shipped to Storm Lake, Iowa. Therefore, the subject of coil and distributor ignition will not be addressed in this chapter.

Original Equipment -- All series "H" tractors were equipped with WICO Type C Magnetos. Later on, the WICO Type XH Magneto becomes the replacement (FSB 159-S, January 1948). All "H" tractors with at least lighting were equipped with Delco-Remy (DR) 1101377 Generator and 1116816 Regulator. E-start tractors were equipped with DR #1109600 Starter Motor. **NOTE**: DR 1101390 generator will also work here (See also Deere TY1441, or SE5011388). **Color Codes** of identification tags for DR generators are black for 6-volts and red for 12-volts.

Painted Parts -- All Delco original parts and light assemblies were thick-painted high gloss black. Starter motors, however, generally ended up green; this is the case with most JD top-mounted starters.

Battery -- Batteries for this tractor were not furnished from the Tractor Factory. They were purchased locally by the receiving dealership. The battery was to have at least 13 plates, and 86-ampere hours (550 to 600 CCA) minimum capacity, and be limited in size to 9-1/16 inches long, 7-1/16 inches wide and 8-7/8 inches high over the terminals. Anti-leak battery caps, which prevent spilling of the acid solution through the vent holes, were considered very desirable and their use recommended (FSB 119-S, 3/15/41).

Generators, Starters and Lighting, A System

Discussion begins with DC generators; their theory of operation and how other electrical system elements affect generator operation. These "other" electrical system elements govern the moment-by-moment relationship between the generator that produces electrical energy, and the battery that stores it. (Take

these to mean not-to-exceed dimensions). Analysis of these relationships will form the basis for "informed" troubleshooting of a non-charging system.

Ammeter -- This is a delicate instrument, part of the operator's console, designed to measure the real time rate of current entering the battery (charge) or leaving it (discharge). Typical full-scale reading is usually 15 amperes. Starter current *does not* pass through the ammeter.

Starter -- This unit is a two-part device, electrical and mechanical. Its electrical part is a basic, high-speed, high-torque DC motor. Its mechanical part performs the interface between this starting motor and the engine, and is called the starter **bendix**.

Cutout Relay -- This is a simple, delicate magnetic switch whose sole purpose is to open the connection between battery and generator output terminal at times when generator output voltage is lower than battery voltage. This prevents the battery from discharging through the generator. This relay is found on tractors using resistor light switches to regulate generator output, and is typical of electrical systems installed on John Deere tractors into the early 50's. Cutout relays are generally polarity-sensitive. Keep this in mind when shopping for a replacement, and when performing maintenance on the electrical system.

Generator -- Considered the heart of the electrical system, this component converts mechanical energy into electrical current (energy). This vital function is performed by moving copper conductors through a magnetic field; a collection of such copper wires form the **armature**, and coils wound around special magnetic-friendly (semi-permanent) material form the **field**. This so-called magnetic-friendly material retains residual magnetism, but along with the field coil winding, also forms an electro-magnet. An increase in field coil current, increases the strength of the magnetic field. With more field strength, there is more generator output current, and vice-versa. Since the basic generation pattern is an alternating current wave, some means of conversion from alternating current to direct current is needed.

This is where the **commutator** and **brushes** come in. The brushes act as pairs of contacts to pairs of armature wire loop ends which terminate at the commutator, an integral part of the armature. While alternating current is flowing in the desired (forward) direction, the contact is made, and as the forward current lobe collapses toward crossover to the opposite direction, contact is severed with that commutator post pair and made with another pair coming into its zone of producing current flow in the desired direction, etc. A clean commutator and integrity of brush contact are essential for proper operation.

Generator Output Control Circuit

Field Current – (Ref Figures 701 and 702) -- As mentioned earlier, it is the strength of the magnetic field in which the generator's armature is rotating that controls armature current at the generator (A), the output terminal. The strength of the magnetic field is dependent on field current rate. And field current is a function of how much resistance to current flow is placed in series with the field coil windings. The "H" tractor uses an externally grounded, **third-brush generator system**.

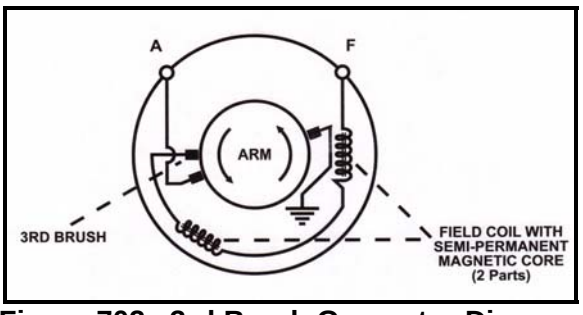


Figure 702. 3rd Brush Generator Diagram

When the armature rotates, voltage is developed at the third brush. Current then flows from the third brush, through the two field coils, out of the generator case via the field (F) terminal, and ultimately to ground through the "light and generator charging rate control switch" (Generator Output Control in Fig. 701). A direct short to ground of the field terminal will result in a high

field current (high-charge) while a return to ground through a resistance will result in lowered field current (normal operation). At essence here is the three-position **Resistor Light Switch,** and in which the position the operator has it. This type of light switch is typical on early farm tractors to perform two functions; one for charge rate control, the other for lights on and off. The **Resistor Light Switch** is used typically along with a **Cutout Relay**. The charge control function of the **Resistor Light Switch** makes it a central element of concern when troubleshooting a non-charging system. If the tractor has a V**oltage Regulator** in place of the **Cutout Relay**, the **Resistor Light Switch** is not part of charge rate control. **NOTE**: This text is in line with original configuration – **Cutout Relay** and **Resistor Light Switch**.

Worthy of mention is a **warning** from your Operator's Manual: If at any time you find it necessary to operate the tractor without the battery, remove the field wire from the generator terminal marked "F" on the generator frame or slip off the generator belt and wire it back against the fan shaft. If the generator is run without the battery, excessive voltage will build up in the generator causing damage to its field coil windings.

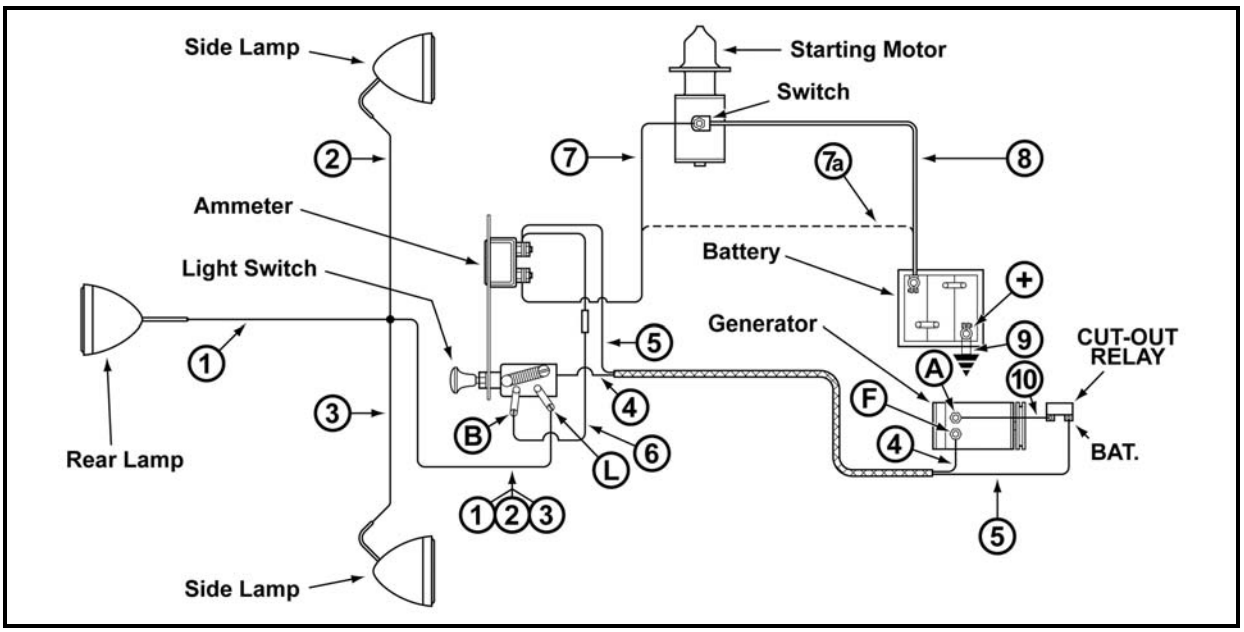


Figure 703. Wiring Diagram for "H" Tractor

Wire Run List, Reference to Figure 703.

Wire segment with numbers **1-2-3 together** is 12 AWG, black, and 24-inches long.

Wire # 1 to the rear lamp is 14 AWG, black, and 37-inches long.

Wire #'s 2 and 3 to the side lamps are 14 AWG, black, and each is 27-inches long overall (NOTE).

NOTE: Wire 1, 2 & 3 segment junctions aren't as simple as the single "dot of connection" in Figure 703 tends to indicate. See Figure 711 at end of chapter for greater lighting harness detail.

Wire # 4, Gen (F) to Light Switch Resistor terminal, 14 AWG, yellow w/green tracers, and 58-inches long.

Wire # 5, Cutout Relay (BAT) to Ammeter, 10 AWG, yellow w/black tracers, and is 58-inches long.

Wire # 6, Ammeter to light switch (B) is 12 AWG, contains in-line fuse holder (use 20 amp fuse; a smaller or larger fuse will not work!), yellow w/black tracers, and is 15-inches in overall length.

Wire # 7, Ammeter to Starting Motor is 10 AWG, yellow with black tracers, and is 18-inches long.

Wire # 7a, Ammeter to Battery (for tractors with lights only, no starter), 10 AWG, yellow with black tracers, and is between 50 and 60 inches long (dress to suit).

Wire # 8, cable from Battery (-) to Starting Motor is 1 AWG, black, 50 - 52 inches long. From the factory, this cable came with galvanized spiral armor, covering the cable in its entirety save for touching the terminals.

Wire # 9, Battery (+) to Tractor is a braided ground strap sized at 1 AWG. Size 2 AWG will suffice in this application due to its limited length of 12 – 14 inches.

Wire # 10, Cutout Relay (GEN) to Generator (A) is 10 AWG, black, and is 15-inches long. ***NOTE***: The length depends on location of cutout, and can be shorter if cutout is mounted on the generator.

➔ All conductors are stranded and cloth-covered, and all terminals are closed loop type, no spades.

➔ For actual on-tractor routing & dressing detail of battery cables and harness, see Figures 707–711.

Ammeter Connection (Polarity) Test -- Use one of the tractor's lights with your 6-bolt battery; Connect Bat (-) to the ammeter "B", ammeter "L" to the light lead, and Bat (+) to the shell of the light. Ammeter discharge indicates a "correct polarity connection". **DO NOT CONNECT AMMETER WITHOUT THE LIGHT,** a 2-ohm resistor rated at 20 watts, or a 1-ohm resistor rated at 40 watts in the circuit.

Resistor Light Switch -- Any number of drawings may be used to illustrate the way this device works. Figure 703 (John Deere "H" electrical wiring diagram) shows there are only three terminals, one of which is depicted as being connected to a resistor (wire # 4). The "unseen" connection is to "chassis ground" via the physical bolting of the light switch to the instrument panel. After roughly six decades, the integrity of that ground connection becomes highly suspect and is at the core of troubleshooting a non-charging system. This could also be a problem with a fresh restoration due to thick coats of paint that may insulate the light switch and/or its sheet metal mount from the battery ground on the frame.

Let us designate the three switch positions as Full-in, Half-out, or Full-out.

Full-in (Lights off, Low-Charge) -- Here the 2-1/2 ohm resistance-to-ground is the return to the generator (F) terminal circuit. Note that the field (F) terminal on the generator goes (internally) to the 3rd brush which picks up energy from the armature's commutator; the energy manifesting itself in the field winding current. The stronger the current, the higher the amount of energy that can be picked off by the (A) brush whose terminal carries current to charge the battery. FULL-IN is the normal operating mode.

Half-out (Lights off, Hi-Charge) -- Let's say you are operating the tractor in a "start and stop" mode in daytime, and the repeated starts "sap" the battery. The operator then positions the light switch at HALF-OUT where the 2-1/2 ohm resistor is bypassed (shorted across – See Figure 701). It is taken out of the field current circuit, decreasing resistance, thus making for vastly increased field current. More field current means a stronger electromagnetic field, which in turn results in substantially increased output (A) current to the battery. Charge rates in this position can briefly peg the ammeter, but should quickly settle between 10 and 15 amps until battery is charged, and then begin to taper off.

Full-out (Lights on, Hi-Charge) -- Lights are turned on, and the 2-1/2 ohm resistance remains bypassed to bring a higher charge level to meet demands of both battery charging and lighting. Charge rate in this position will vary depending on the 3rd brush setting, and is equal to total generator output minus the energy needed for lighting. The remaining amount is battery charging current, and this is the amount that will be read at the ammeter. With the tractor engine running at normal high idle speed, and all lamps burning, the ammeter should show from 1/2 to 2 amperes charge, FSB 106-S (2-15-40). For tractors equipped with lighting only, set charge rate to these values with switch at Full-in (lights off).

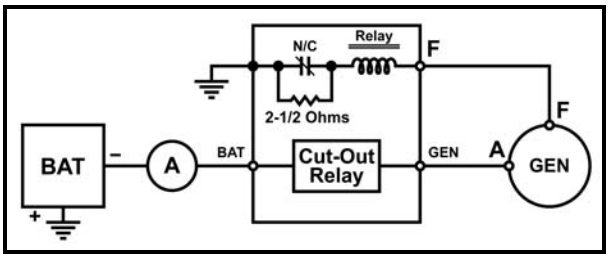


Figure 704. Voltage Regulator in Externally Grounded System. Light Switch Deactivated.

Voltage Regulator -- Over the years, night operation of the "H" tractors pretty well became a part of history. Either as a result of light switch problems and/or degradation and non-use of the tractor's lighting, many have resorted to using a Voltage Regulator (VR) - eliminating the **resistor light switch** function entirely. They may even have installed a single-function light switch designed to control lighting only. The cutout relay in the VR behaves just as described in the **Cutout Relay** paragraph, and is housed in the VR.

The field terminal of the generator connects to the (F) or field terminal on the VR. In the VR is a relay whose contacts are normally closed, and across the contacts is a resistor of roughly 2-1/2 ohms. Thus the resistor is bypassed until generator output (and also field current) build to a preset level. This level energizes the relay to open the contacts, putting the resistor in the field coil circuit which, in turn, decreases generator output by decreasing field current. The decrease in field current allows the relay to collapse once again making a short circuit around the resistor. Then the current build-up to energize the relay begins all over again. This cycling action can repeat a several hundred times per second!

Charge Rate versus Charge Control -- Rate of charge is established by a physical setting (the position) of the third brush. Whether to have hi-charge or low-charge is a function of the position of the resistor light switch (or voltage regulator). In the field current paragraph above, voltage is present at the third brush when the generator is being driven. By physically moving the third brush closer to the armature pick-off brush (A), the charge rate can be increased, and moving it further away from the (A) brush will decrease charge rate. This setting can be made only after removing the inspection cover from the generator. Consequently, it is not revisited on a regular basis. That cover is a steel band nearly 2 inches wide, normally retained in position by a single fastener. Removing this cover provides access to all of the brushes and the commutator as well. While a "smart set up" is used by a serviceman to set the third brush, an educated guess is to place it some four commutator bars away from the armature (A) brush as a starting point.

If you operate your tractor without use of the lights or use them only occasionally, the generator charging rate should be adjusted to between 1/2 and 2 amps at fast idle. If during busy seasons you operate the tractor all night, the charge rate must be set so ammeter shows a 4-1/2 amp charge rate. Both adjustments are made at fast idle (1540 RPM) with the light switch Full-in (lights off, low-charge).

The Starter

This two-part device, DC motor and **bendix**, cranks the engine. When the starter switch is placed in the start position the starter spins at a high rate of speed. Centrifugal force moves the spring-loaded bendix inward to engage the flywheel ring gear teeth, which turns the engine to initiate the start. There is no known preventive maintenance for the bendix other than keeping dirt and grime away from the unit. Usually, the first indication of bendix malfunction is when you attempt to start the engine, the starter spins with no load and sounds like an electric motor running (which it is). Usually, this is caused by a broken bendix spring or a jammed sleeve or sleeve screw.

Ring Gear -- Decades of use will take their toll on the (gear) teeth of the H1008R pinion and the H914R ring gear. While the P/N H1008R is still valid on the Deere & Co. parts page, these parts are scarce and

will present a procurement challenge. If you need replacement parts, begin your search early. Two Cylinder and Green Magazines are your main link to both after-market sources and sources for new old stock (NOS) parts. Before you remove the ring gear, take notes, or better yet, take a couple of pictures that depict precisely where the gear is on the flywheel and its orientation for reference during reinstallation.

The **ring gear** can be driven off the flywheel and a new one shrunk on. After soaking a few days with periodic applications of PB Blaster or Kroil to lessen the "rust-bond" and a mild application of heat on the gear to provide expansion needed, you should be able to drive the ring gear off the flywheel with reasonable ease. After a really thorough cleaning and removal of any burrs that may have been caused during removal, install the replacement ring gear with the beveled edge of teeth **AWAY** from the crankcase.

Starter Failure Modes -- There are three main failure modes: (1) bendix failure as outlined above, (2) completely dead -- no response whatsoever to energy applied, and (3) the starter will engage the flywheel's ring gear and stop! For the completely dead starter, troubleshoot by measuring battery voltage into and out of the starter switch, and if battery voltage is being applied to the starter's armature but there is no response, it is time to have the starter reworked by a professional.

Shimming the starter -- For the starter that engages the flywheel's ring gear and then stops, look for misalignment in the way the starter pinion engages the ring gear. Alignment may be correctable by shimming. You may place shims between the starter bracket and the main case, and/or between the starter and the bracket. If the starter isn't parallel to the crankshaft, shims in the neighborhood of 20, 30, or even 40 thousands of an inch, on one side or the other, can make the difference when placed between the starter bracket and the main case. Be watchful, however, that when placing shims between the bracket and main case, that you (in effect) are moving the starter so as to increase the amount of bendix travel required for full engagement between starter pinion and the ring gear. If engagement is lacking after shimming between the bracket and main case, you may need to consider shims between the starter and starter bracket to regain engagement lost in the shimming between bracket and main case.

Other reasons for stalling of starters could be bad brushes, burned starter switch contacts, corroded battery terminals, loose starter on bracket mounting holes, or anything else that adds resistance to the current flow.

While theory is not in the scope of discussion here, DC Motor theory is at the heart of a starter. The motor is very heavy duty. A massive amount of current is drawn in normal operation, and even more by starter motors needing maintenance. Preventive maintenance here would be annual inspection and cleaning of the armature and brush contacts, replacing as necessary. DO NOT use emery cloth on electrical armatures! It is conductive and may short the armature.

Battery Cable Test -- Measure voltage drop across each cable during an attempt to start. With digital voltmeter in hand, touch the negative lead to the center of the battery (-) post and the other lead to the center of the bolt on the starter terminal while a helper engages the starter. Perform a similar test by touching the positive lead to the center of the battery (+) terminal and a good tractor (chassis) ground. If a reading exceeds 0.25 volts, perform cleaning and/or maintenance on that cable and retest. If failure persists, replace the failing cable(s).

Troubleshooting Generator Failures

Core Principle -- The core principle in any troubleshooting series is to decidedly eliminate variables, one-by-one, until you isolate the cause of the system's failure. More often than not, that cause is the final element in the equation!

The Battery -- In this sequence, a battery known to be good helps to make better decisions as individual routines are performed. Put your battery on the battery charger and monitor the amp gauge. There should be more amps at the beginning but then taper off over a span of several hours. If the charge rate starts off high but then rapidly decreases to near zero within 10 to 20 minutes, your battery may be "soft" and unable to hold a charge. A load test is always a great idea -- some auto parts stores still do this as a free service.

When reinstalling battery, re-polarize generator. See "Polarize the Generator" below, or Appendix 13.

CAUTION! Batteries can explode. Always wear proper safety gear when handling and charging.

The First Step -- Always perform a thorough visual inspection and physical check for clean and secure wiring connections, battery electrolyte is clear and covering all the plates in each cell, and that the belt is sufficiently tight. Verify the configuration of the electrical wiring. With a standard JD 6 Volt DC generator having a field (F) terminal and an output (A) terminal, you should have either the resistor light switch configuration per wiring diagram, or an alternate such as with a voltage regulator. This discussion assumes original configuration.

Causes for a "no output" complaint include a poor connection (usually a bad ground), ammeter stuck, defective generator or cutout relay, defective light switch, or even a battery with one or more bad cells. It is assumed that the generator has been polarized. If not, perform polarization before proceeding.

Polarize the Generator -- If the generator or battery has been removed from the tractor or even only disconnected; or when you receive that repaired and/or reconditioned generator back from the shop, it is possible that the polarity of the generator may be reversed. If generator output polarity fails to match storage battery polarity, delicate, polarity-sensitive devices may be ruined. For instance, reversed generator polarity will cause the cutout relay points to vibrate and burn. See Appendix 13!

To Polarize your Generator -- After all connections have been made and **before** engine is started, connect a jumper, Generator (F) Field terminal and Ground. Connect one end of a second jumper to the BAT terminal of the cutout relay or VR. Then, while carefully watching for a spark, MOMENTARILY contact the other end to the Generator (A) Output terminal (A momentary jump across the cutout relay). You should detect a spark. And if you did, the generator is polarized and both jumpers are now removed.

If there is no spark, this generator would fail the motor test (below). Before jumping to conclusions, however, double-check to ensure you measure battery voltage at the BAT terminal of the cutout relay, and that all jumper wire connections were/are sound.

Ammeter -- Check to see if the ammeter will show a discharge when lights are turned on. Get out your voltmeter. ALWAYS measure battery voltage at each post of the ammeter, AND at the BAT terminal of the cutout relay -- no exceptions.

Resistor Light Switch – With engine running, jumper the field terminal to ground. If output comes back, there is a grounding problem -- most likely at the light switch. Be especially aware that ground for the Generator "F" Field terminal using the light switch derives this "ground" connection by both mechanical

and electrical contact made between the light switch and the sheet metal of the tractor. Six decades can radically alter this relationship.

Cutout Relay (or Voltage Regulator) Test -- Engine running – with generator (F) field terminal-to-ground jumper in place, connect a second jumper between the two cutout relay terminals, GEN and BAT. If output comes back, the cutout relay is at fault. The cutout relay is a delicate, polarity-sensitive magnetic switch. Its purpose is to DISCONNECT when battery voltage is higher than generator output voltage, and CONNECT when the generator output voltage is greater than battery voltage.

Generator -- You have made sure you have a good battery, the ammeter is functional, you have battery voltage at the BAT terminal on the cutout relay, and with jumpers installed from generator (F) to ground, and across the cutout relay -- yet there is no charge (generator output) showing -- the generator is the problem! Remove the jumpers, and stop engine.

Generator Motor Tests -- Remove the drive belt, tractor-to-generator. Disconnect system lead to generator (F) terminal. Connect a jumper from Generator (F) Field terminal to Ground. Connect a second jumper from the BAT terminal of cutout relay (battery voltage) to Generator (A) Output terminal. A good generator will spin (Test 1). Remove the jumper from Generator (F) Field terminal to Ground, and a serviceable generator will speed up (Test 2). Failure of Test 1 indicates a generator with bad brushes, a bad armature, or with a mechanical problem such as bearings and/or bushings. Failure of Test 2 points to an open field coil circuit. DC resistance (both field coils in series) should be from 2 to 3 ohms. Beware of a possible bad connection between the two coil sections.

Motor Test Rationale -- In Test 1, there will be current flow in a GOOD field coil circuit which generates a counter electromotive force to oppose rotation. And so, when in Test 2 the field coil circuit is ungrounded (opened) and current flow ceases, the counter electromotive force goes away – allowing for an increase in spin speed.

Lights -- No rocket science here. Connectors and light sockets must be free of all forms of corrosion or debris (squeaky clean) and wires must be of the correct gauge with insulation intact. Firm crimping or soldering of connectors to wires are essential when dealing with 6-Volt lighting systems.

Generator and Starter Repair -- I recommend that any necessary repairs be performed by a professional. Always seek out a local starter/alternator repair facility in your local neighborhood before reaching out. Alternately, see Appendix # 3 and (also) either Green or Two Cylinder Magazines for service vendors.

Parts Sourcing -- Most repair shops will know the aftermarket and have no problem securing the parts needed to repair your generator or starter. If you strike out with your serviceman on parts, Appendix 3 will identify fallback sources to include John Deere.

Magneto Ignition Systems

Theory of Operation -- In a single electrical element, the magneto combines a low-voltage generator and a coil composed of primary and secondary windings built up around a laminated iron core. The coil is actually a transformer. When discussing a transformer, it important to understand the term "turns ratio". This is a ratio of the number of turns (wire loops) in one winding compared with those in the other. In a magneto, the secondary-to-primary turns ratio is very high. This means a small voltage change in the primary winding will induce a huge voltage change in the secondary winding. When closed contact points open, the magnetic field generated by current flowing in the primary winding is collapsed. This "change in direction" in current flow induces a high voltage spike in the secondary winding that is directed by a distributor to the spark plugs. The magneto generates its own electricity. No outside source (e.g. a battery) is required. NEVER CONNECT AN EXTERNAL VOLTAGE TO A MAGNETO!

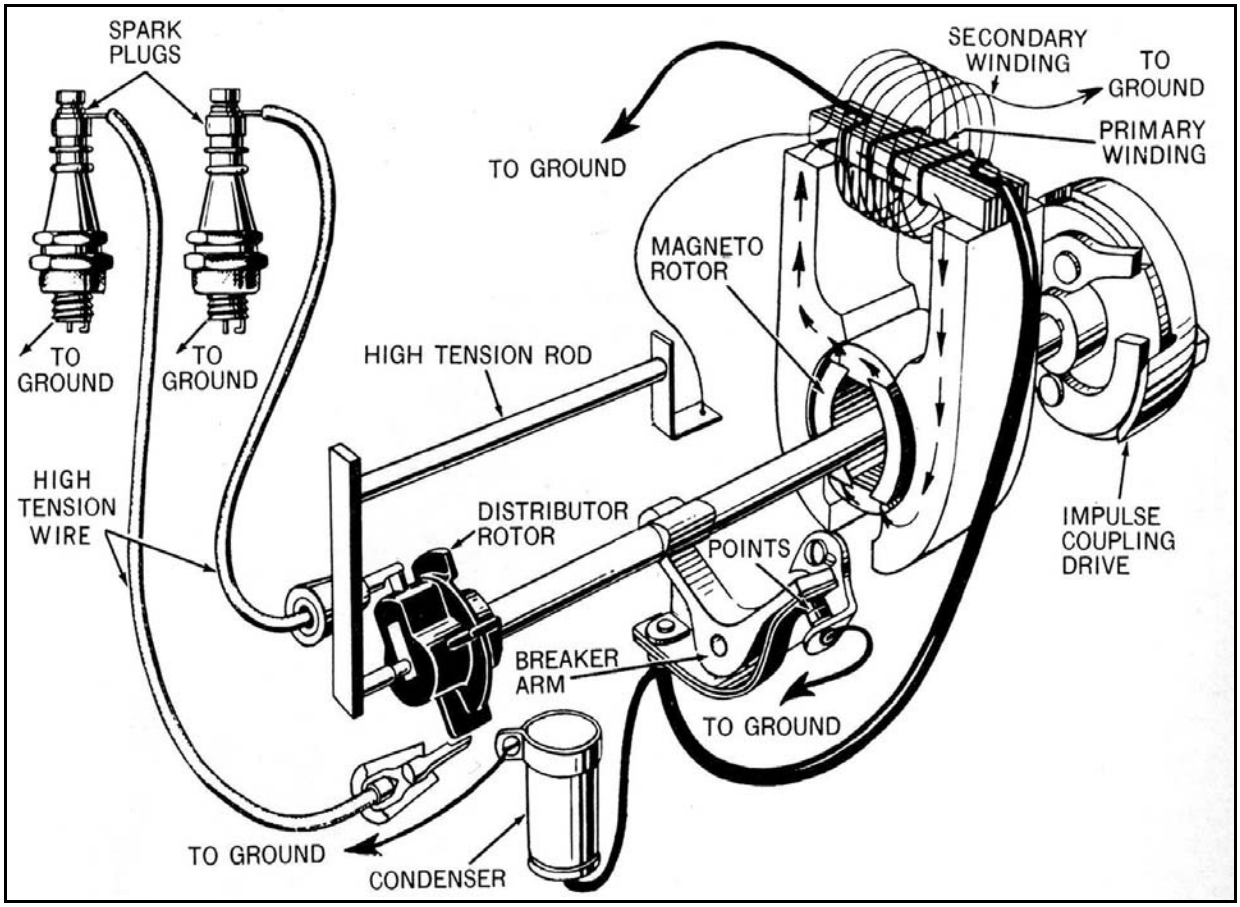


Figure 705. Magneto Ignition System

The magneto rotor (Figure 705) is a powerful permanent magnet. When it is turning, this magnet induces current flow through the primary circuit provided the contact points are closed. Rotor motion results in a magnetic field build up around the coil. When the primary current is at its maximum, the contact points are opened by a cam on the rotor shaft. This results in an instantaneous collapse of the magnetic field. When the field collapses, magnetic lines of force cutting across the secondary winding induces a high voltage.

The collapse of the magnetic field also induces voltage in the primary winding. The surge of current in the primary winding caused by this induced voltage is absorbed by the condenser, which discharges back into the coil and extends the time of the high voltage discharge. This reduces arcing and possible burning of the contact points.

The high voltage secondary winding output is directed to the distributor rotor, which in turn directs the voltage through the spark plug cables to the correct spark plug at the proper time. The spark jumps across the gap between the electrodes of the spark plug, igniting the fuel/air mixture within the combustion chamber.

TIP: While these words might seem to flow easy in theory, real life is often more complicated and challenging. Delving into a magneto without detailed guidance and training and proper test equipment can lead to a very unpleasant experience. It's okay to perform preventive maintenance, but seek expert help before deciding to overhaul your own magneto. Excellent videos are available which take you

through all of the important steps of magneto repair. They are useful even if you don't plan to do your own magneto work.

The Impulse Mechanism

A device called an "impulse mechanism" is part of the drive coupling mechanism in every WICO C and XH magneto. The action of the impulse mechanism can be envisioned as follows:

Visualize -- Imagine a special electric clock with a sweep second hand, but with another identical hand on the same shaft. However, this redundant second hand is able to spin freely on the shaft and is not geared to the clock drive. Now, suppose this loose hand is tied to the sweep hand with a torsion spring (such as a clock spring). Accordingly, the loose hand moves along with the rotation of the driven hand, and so they both spin together around the clock face. Now let's add another detail. Suppose a little catch or dog of some type is added to our clock that grabs and stops only the loose second hand as it (and the driven hand) passes the 12 o'clock mark. So now, the movement of the loose hand is arrested at 12 o'clock, but the driven hand continues to rotate. As this happens, the spring connecting the two hands starts to stretch. Next, imagine the catch holding the loose hand being tripped open as the driven hand passes the 3 o'clock mark. Once freed, the loose hand instantly jumps ahead and catches up (with a bang) to the driven hand, just like a mousetrap snapping closed. Then, both hands rotate in unison back around to the 12 o'clock position where the exact same process repeats.

Transition -- The above example shows approximately how an impulse mechanism works. In reality, as the engine is rolled over during cranking, the magneto tags along in lockstep, driven by the governor shaft through the drive cup at the same slow speed—until it encounters a "catch". (In the magneto, this means a little arm called the impulse pawl catches on the stationary impulse stop.) Then, the magneto drive cup continues to rotate for another 60 degrees or so while the magneto armature remains motionless. After being held stationary, the armature is suddenly released because a tab on the revolving drive cup (which is keyed to the engine rotation) sweeps past and trips the impulse pawl. The coiled drive spring inside the impulse mechanism causes the armature to instantly jump ahead and catch up to the drive cup, just as the engine reaches TDC (Top Dead Center). The snapping sound heard in a healthy impulse mechanism during cranking is the result of the spring-loaded armature in the magneto bumping into a rotation stop when the armature catches up with the drive cup.

If spun faster than about 250 RPM, the impulse mechanism doesn't engage. Influenced by a delicate balance between gravity and centrifugal force, the impulse pawls retract at running speeds and allow the magneto to rotate continuously, and in direct synchronization with the engine.

"**Catch and Slingshot Release**" **--** The impulse mechanism performs two vital functions:

First, the "catch and slingshot release" design causes the armature to spin fast enough to generate sufficient energy to create a spark, even though the engine may be rotating very slowly. WICO Magnetos are incapable of generating spark at cranking speeds. The impulse mechanism spins the armature really fast through a brief, short 60 degree angle, and that's enough to develop a spark.

Second, the impulse mechanism automatically retards the spark timing to coincide with the piston arriving at TDC for ease in starting. The magneto ignition run timing is typically 30 degrees BTC (Before Top Center), but is a function of the particular magneto drive cup chosen. Without the spark retarding effect created by the impulse mechanism, engines would kick back during starting attempts, because they would fire well before the crankshaft arrived at TDC.

Automatic Switch in Timing -- The magneto is timed 30 degrees in advance of the engine TDC. That is, if the impulse mechanism was inoperative and you slowly rotated the engine and watched the points, you would discover the points opened (which would cause spark at a plug) when the crankshaft was approximately 30 degrees BTC. Now, imagine the impulse is working properly. As the engine is slowly rotated, the impulse stops armature rotation at about 60 degrees BTC. As the crankshaft reaches TDC, the impulse suddenly releases the armature, and it immediately spins and causes a spark—that coincides with crankshaft arrival at TDC. When the engine starts and magneto speed passes approximately 250 RPM (Ref. FSB 159-S, 1-16-48), centrifugal force prevents the impulse from engaging anymore, and everything putts along perfectly, with the ignition timing locked in at the run timing determined by the magneto drive cup which is typically 30 degrees BTC.

Magneto Timing

All discussion will be applicable only to WICO C that were installed as original equipment on John Deere Model H Tractors (and later XH as a direct replacement). Relative to other literature on magnetos, all magnetos in the JD H group are "CCW" magnetos meaning they are driven in a counterclockwise direction as viewed from the drive cup end of the magneto.

Lag Angle -- The lag angle or impulse range is the angular amount of retardation in timing between a magneto at cranking speed and one at running speed. The drive cup installed and the impulse stop plate adjustment are the factors that determine this relationship. For the JD H, this angle was set at 35 degrees for H1000-16199, and at 30° for H16200-up. The drive cup determines the running timing, and starting (also called impulse) timing is adjusted by the position of the impulse stop ring on the drive cup end of the magneto. NOTE: For gasoline operation, the trend is toward a 25 degree lag angle. All discussion herein will state 30 degrees.

Starting Timing should be very close to TDC. Some observers say that an advance of several (not more than 4) degrees BTC makes easier hand starts for the early JD tractors. Others claim it makes starting more difficult and is especially hard on a starter motor. Starting timing is easy to detect. No instrument is required. It occurs as the magneto sounds with its familiar "snapping" click.

Running Timing -- The amount of advance BTDC is determined by the specific drive cup installed on the magneto. The switch from starting timing to running timing is an automatic function. Running timing is the result of the specific drive cup installed and the position of the magneto on the tractor. Rotate the top of the magneto to the rear for more advance, and forward to reduce the advance. The "rotating" action or phenomenon is similar to loosening the locknut and rotating the distributor on a '57 Chevy. For those adept in timing light use, this adjustment can be performed on a running tractor! See "Timing" paragraph below.

Wear -- Running timing is also affected by points setting, points arm wear or cam lobe wear, and wear of other magneto parts and engine parts. It is safe to assume that any magneto on a 60-year old tractor will have sufficient wear to warrant overhaul by someone well qualified to do so. This is not a task for novice owners of these tractors. Without knowledge of the condition of the impulse parts, it is nearly impossible to understand what problems lie in wait. "Just leave it alone" for an expert to deal with.

Magneto Types -- The magnetos you should find installed are C1042 with a 6274 (sub 2061B) drive cup (25 degree cup) 1300 with a 3565 drive cup, [rare] (35 degree cup), and an occasional 477. but in the main, you can generally expect to find WICO "C" with 6274 (sub 2061B) drive cup, or WICO "X" with 6274

drive cup. All will have short lugs. The 477 originally came with a long-lug 3744 drive cup (35 degree cup) for an earlier vintage JD tractor. While you might expect to see these numbers on the magneto data plate, don't count on it! They are the same magnetos except for the different drive cup. Drive cups are interchangeable on all CCW magnetos for JDs. The H came from the factory with a C1042 magneto. There are many other WICO models than these three, however, they will not work on the H because spark timing from the magnetic rotor unit is not compatible.

Over the years whenever dealers or magneto repair shops lacked the necessary spare parts, they would make substitutions as needed to get the job done. Once the tractor was operational, they would rarely go back and restore the original configuration.

Test Stand -- At this point it is important for you to know that the specific amount of starting advance (lag angle) is established by a specific setting of the impulse stop plate. This is established in accordance with a chart specific to the drive cup being used which is as it was designed. In theory, it assumes no wear of the physical parts in the magneto. But even with all new parts installed, there may be differences in outcomes because of allowable variances in factory tooling and individual methods of assembly. This is why those in the business of repairing and/or rebuilding magnetos need to have a test station. A "target setting" is made, the magneto is test run, and the settings are then "fine tuned" to achieve the desired lag angle. For tractor owners, the tractor itself is the only test stand they have! So how does one use their tractor to set lag angle?

Perfect Timing -- If you have a timing light and know how to use it, establish a reference point on the tractor for TDC. Then mark the flywheel at 30 degrees BTDC in relation to the reference mark. Start the engine and set timing by rotating the magneto forward or to the rear. Next, scribe two index or registry marks, one on the magneto flange and the other on the governor housing. In-register condition of these marks represents your running timing. Stop the engine and remove the timing light. Rotate flywheel forward slowly, observing when the impulse occurs. If it is at TDC, you are finished! If impulse comes before it should: remove the magneto, loosen the four screws securing the impulse stop ring, and rotate the ring CCW ever so slightly. Reinstall the magneto ensuring those two new marks you made are in register and check your impulse timing again. Repeat this process of trial and error until you achieve the impulse timing desired, then secure mechanical and electrical connections. This procedure represents the proper method to achieve perfect magneto timing at the factory-specified 30 degrees BTC for running conditions, and the ignition timing for starting is as TDC.

Designed Timing -- However, a quicker procedure that usually produces adequate, but not perfect, results is to set the impulse stop plate so its witness mark is aligned with a point between the third and fourth mark (left) on the magneto case. This represents the initial recommended setting for a WICO C or XH magneto, with a 30 or 35 degree drive cup, and creates a 30 degree lag angle (based on unworn parts). The center mark (of 11 marks) represents a lag angle setting of 13 degrees (2061B or 3565 drive cup). Each mark represents 5 degrees. Setting the impulse stop ring's witness mark to the left between three and four marks (from center) means the lag angle will be 13 degrees plus three and one-half times 5 degrees, which equals a theoretical 30.5 degree lag angle. Then, merely mount the magneto in accordance with the instructions outlined in your Operator's Manual. The ignition timing during running will end up being adequately close to ideal for most “playtime” activities.

Troubleshooting Magneto Ignition Systems

Most people are intimidated by the magneto for the simple reason that there is limited need to get in and fix them! They are tremendously reliable, yet incredibly simple. They usually require little more than

preventive maintenance and they work like a charm. New points, condenser, rotor and maybe rotor distributor cap replacement along with new gaskets will do wonders for nine out of ten magneto ignition systems. If this is your first experience doing preventive maintenance on a magneto, make notes and take pictures to ease anxiety during reassembly. Journal what you find, as you find it.

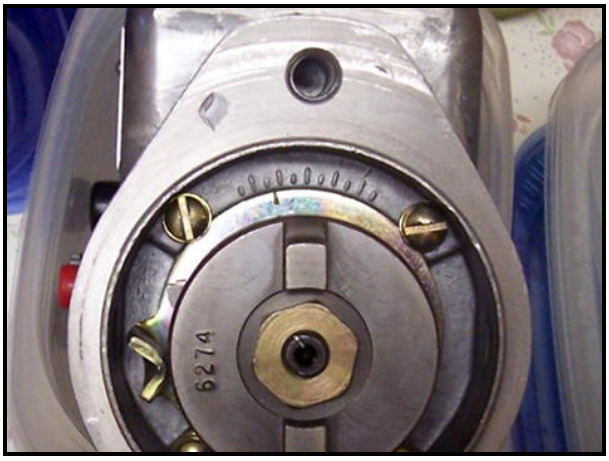


Figure 706. Note eleven marks in the housing, and one witness mark on the impulse stop plate.

NOTE: For XH-1042 magnetos with a 6274, 25-degree drive cup, the center mark represents **3 degrees** (not 13). Each mark still represents 5 degrees as with the others.

This statement may not hold for current-day after-market Type XH magnetos. Lag angle must be set up on a test stand, or by use of timing light and "trial & error" setting of the impulse stop.

Spark plugs -- Examine spark plug cables and be sure they are tight in terminals at magneto and on spark plugs. Remove spark plugs from cylinders and check gap between points. Reset to 0.030-inch if necessary. DO NOT BEND THE CENTER ELECTRODE. Place spark plugs, with cables attached, against cylinder block, being sure neither spark plug terminals nor cable ends are in contact with the cylinder block or other tractor parts. Turn top of flywheel forward (counter-clockwise) until impulse starter of magneto has clicked two times. There should be one spark at each plug during this time.

Safety Alert! People have been severely burned, some fatally, by removing spark plugs of a flooded engine and spinning the flywheel. Raw gasoline is squirted out of the spark plug hole directly onto the person spinning the flywheel. At the same time, the magneto impulse trips and creates a spark between the loose plug wire and the engine block or frame. This can create an instant inferno out of the operator who is caught totally off guard. Be extremely cautious regarding this possibility.

If no spark has occurred at the plugs, remove cables from plugs and hold ends of cables about 1/8- inch from cylinder block. If a good spark is obtained here, the trouble is in the plugs, and they should be cleaned or replaced. **NOTE**: Use a clean dry cloth to clean the insulator being careful not to scratch the porcelain on the insulator.

Alternative spark test -- An inexpensive spark-testing device can easily be fabricated from a length of stranded metallic core plug wire (auto parts store or your old parts) and a short piece of 1/4-inch ID clear plastic tubing (hardware store). Cut the plug wire in half and insert each of the severed ends into the clear tubing leaving between 3/16 and 1/4 inch gap between wire ends. Connect this new wire between the magneto and spark plug and actually see the spark jump. The tractor will start and run with this tester in line.

Impulse Testing -- If spark testing fails, listen carefully to see if the magneto makes a good loud, crisp snap sound as you crank the engine. If not and there's no spark, or a weak spark, the magneto's impulse spring assembly may be the problem, or it may just be a weak spring. If it's a weak spring, you should be able to pull start the tractor. If the spring is broken, there is no guarantee that the drive cup is held against the impulse stop plate, so starting timing could be way off.

No Impulse but Magneto Hand Checks Okay – Most likely cause is magneto drive cup failing to engage driving flange on governor shaft. Using mounting flange as reference, measure for engagement of impulse drive cup with magneto driving flange. The cause is that the governor shaft has moved to the tractor's left. A "quickie" test is by observing presence of excessive fan shaft backlash. At fault is the L.H. governor bearing.

Spark Plug Cables -- If no spark is obtained when checking under the heading of "spark plugs", remove cables from magneto. Bend short pieces of wire and insert in magneto terminals so that ends of wires are within 1/8-inch of some metal part on the magneto frame. Turn flywheel as before, and observe whether sparks are obtained between ends of wires and frame. If sparks occur here, it indicates defective or broken cables that should be replaced. In case no spark is obtained, check magneto.

Basic Magneto Acceptance Test – Connect test plugs gapped at 9 mm (approx 11/32-inch) to magneto. As long as magneto is rotated, there shall be uninterrupted spark at each plug (minimum performance test).

Spark Plug Cable Length – For No. 1 cylinder, length is **39-inches**, and for No. 2, length is **31-inches**.

Stranded Metallic Core Wires -- Good wire-core plug wires are required, NOT the carbon-core suppressor types. If some kind of RFI suppression type wires are installed, replace them with wire-core plug wires.

Magneto -- Remove the distributor cap and wipe out cap with a clean cloth ensuring that ventilator holes are open. Remove the distributor rotor from the shaft, by pulling it straight out. Then wipe rotor and shaft clean.

Worn Shaft Bearings/Bushings -- With the rotor removed, grasp the exposed shaft protrusion. You should not be able to detect any radial play in the shaft. Such play causes havoc with point gap adjustment, and also indicates the magneto armature may be able to rub against the field laminations. Armature contact with field laminations can also be a cause for no spark, and will quickly destroy a magneto. New bearings and/or bushings are in order.

Points -- If there's no spark, or a weak spark but the magneto is snapping good, inspect the breaker points for being dirty, burned, pitted, or badly covered with carbon. Polish, do not file. You can use medium grit (ex 320) aluminum oxide paper cut into strips. Fold over and draw a folded-over piece through points until they are smooth and bright. Set breaker points to a gap of **0.015 inch**. Examine breaker arm and see that it moves freely.

TIP: If the points are only slightly tarnished, drawing a new Dollar Bill through the points while under tension works wonders!

TIP: The points in a magneto remain a key player in both the timing and amount of fire. If filing is required to get the engine up and running, you do it. But, resolve then and there to renew those points soon! Their length of quality service is over.

Condenser -- This is a low-cost item that is difficult to test with equipment routinely on hand. You can test for leakage only -- using an old-fashioned analog volt-ohm meter. It is best to replace the condenser if you have any reason to suspect its bad

As you examine the points and condenser area, look for clean and secure connections as well as serviceable insulation on the leads.

Coil Resistance testing -- Observe from **2 to 4 ohms** for primary winding, and from **6000 to 8500 ohms** for secondary winding reading.

Replace distributor rotor and distributor cap, making sure that distributor gasket is in place and in good condition. Check for spark as in "spark plug cables". Replace cables, upper magneto terminal to left-hand spark plug (No. 1) and lower magneto terminal to right-hand spark plug (No. 2).

Get Help -- If you cannot get your magneto working and need help, see Appendix # 3 for quality service providers, and you can find help on the Internet. For those without Internet access, magazines like Two Cylinder and Green Magazines cater to this endeavor.

Spark Plugs -- The "H" originally came with Champion 8Com-C plugs or Edison-Splitdorf Z-19 spark plugs, which are often available NOS from plug dealers. All plugs for the "H" are 18 mm threaded and gapped to 0.030-inches. When working field conditions as designed, basic cold to mid-heat range plugs do well. However, for extremely light, no-load operation like parades, one is probably better off with hotter plugs. As the list unfolds, beware of D23 as the plug is longer outside the chamber and may arc over to the shield. From hottest to colder, by brand we have:

Autolite [378, 377, 3077, 3116, & 376 (378 = D23)],

AC [C88L, C88 & C87],

Champion [D23, D21, D18Y, UD16 & D16], and

Denso L14-U. **Denso** L14-U is the same as D21 so far as heat range is concerned.

Some types are becoming obsolete. Thus, whenever you can, seek New Old Stock (NOS).

CAUTION: Many cross references found in stores cite plugs not listed here. Check them out! RESISTOR type plugs are not suitable mates for your magneto!

TIP: Spark plug fouling is a major concern when operating in light duty applications. The two main ways to reduce fouling are to maintain the leanest possible settings at the carburetor, and do your best to operate the engine within a heat range of 195 to 205 degrees F (FSB 74-S, 6-15-37).

TIP: Crossed Wires -- The wire leading to the No. 1 plug (flywheel side) should show its spark as the L.H. IMPULSE mark on the flywheel passes its reference mark on the sliding shaft bearing housing (At 3:00 o'clock). The No. 2 plug wire should show its fire one-half CCW turn of the flywheel later! If the magneto is installed 180 degrees out of time (they fit into the governor shaft's drive slot either way), a top-to-bottom wire swap at the magneto will compensate for the timing reversal. WICO C or WICO XH are “direct-drive” magnetos that fire at BOTH Top Dead Centers of the power stroke and the exhaust stroke. The “extra” spark occurring during exhaust has no effect on engine operation.

Installing the Magneto

CAUTION: Remove spark plug cables from plugs and connect them to Ground to prevent accidental starting or fire.

1. Remove No. 1 (flywheel side) spark plug. Bring engine to No. 1 at TDC of its combustion stroke as indicated by pressure build up. Flywheel L.H. Impulse should be at its timing mark, or at 3:00 o'clock. The slot in magneto flange on governor shaft should be horizontal.

2. Secure a short lead into the upper terminal of magneto distributor. Hold magneto in the same upright position as if it were mounted to the tractor. Gripping the drive lug on the impulse coupling, turn

coupling to the left (CCW). Stop immediately when impulse occurs and spark occurs at the inserted lead. The driving lugs on the magneto should be in horizontal position.

3. Replace magneto and its gasket onto the governor case, being sure the driving lugs of the magneto are engaged into the magneto flange on the governor shaft. Hand-tighten fasteners and rotate magneto top forward as far as it will go. Rotate flywheel (top forward) one complete turn and line its L.H. Impulse mark with its timing mark, or at 3:00 o'clock.

4. Tap the top of the magneto toward the rear of the tractor a small amount at a time until the impulse trips. BE CAREFUL - TRY TO NOT OVERSHOOT.

NOTE: If you do overshoot, return to step # 3 above and retry.

5. Tighten the cap screws holding magneto and install spark plug cables. Ensure the flywheel side plug is connected to the upper magneto distributor terminal.

Electrical Illustrations

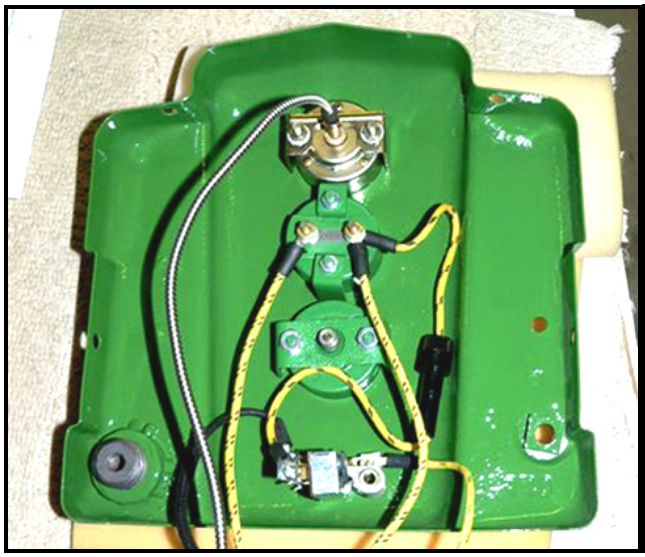
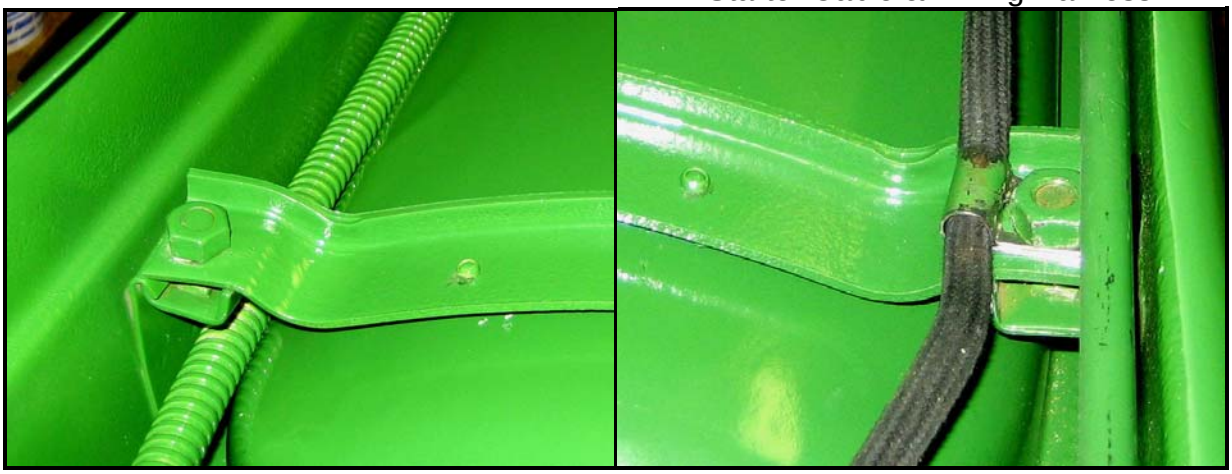


Figure 707. End Cap Wiring

Figure 708. Under-Hood Dressing, Starter Cable & Wiring Harness.



Figures 709 (A&B). Detail of Starter Cable and Wiring Harness Dressing

Battery Connections & Dressing

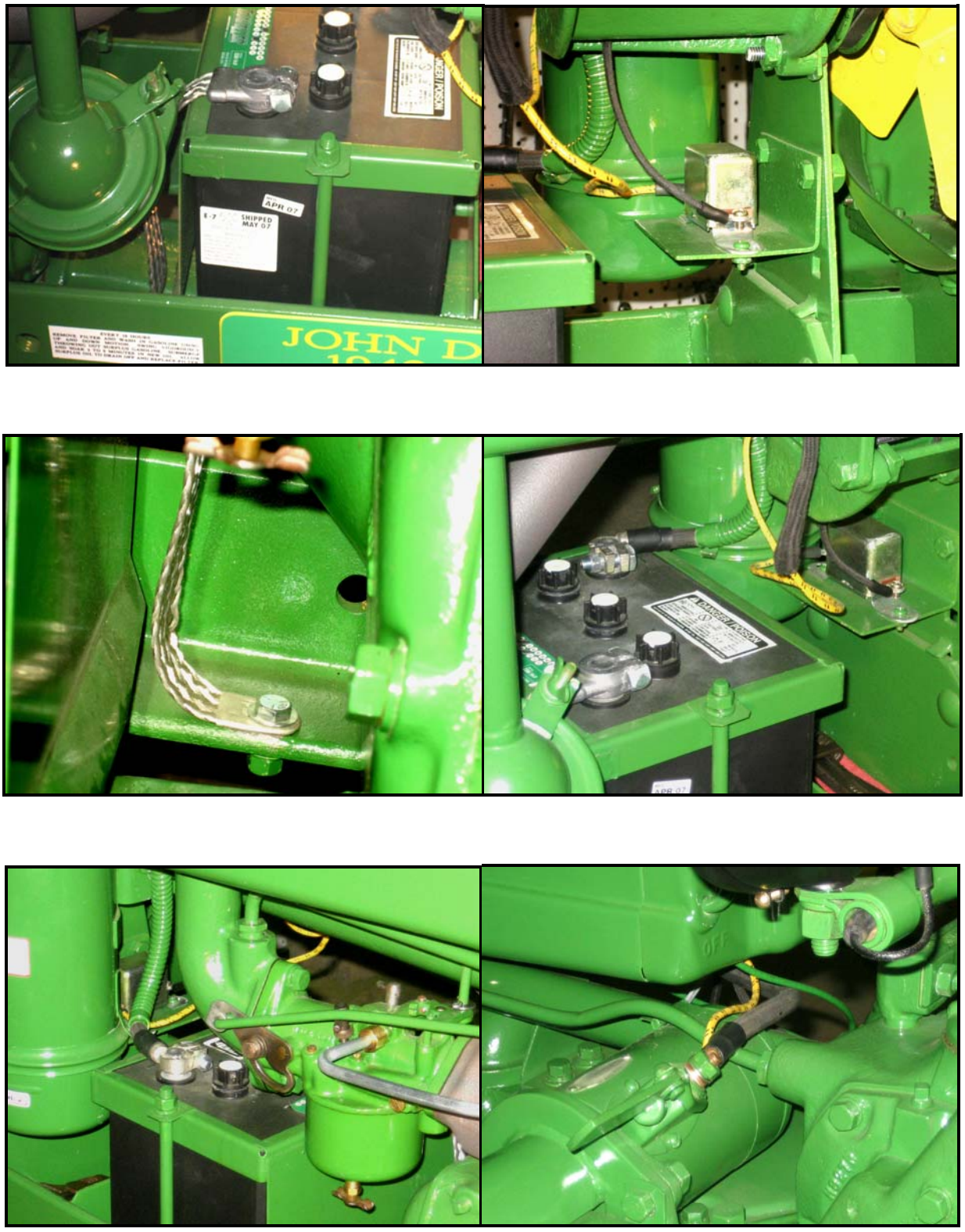
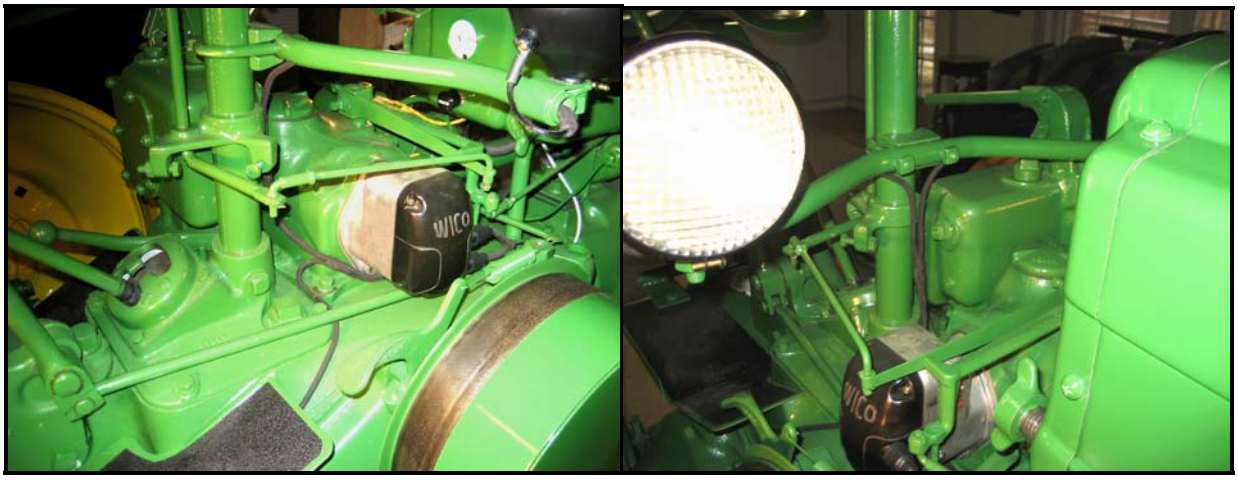
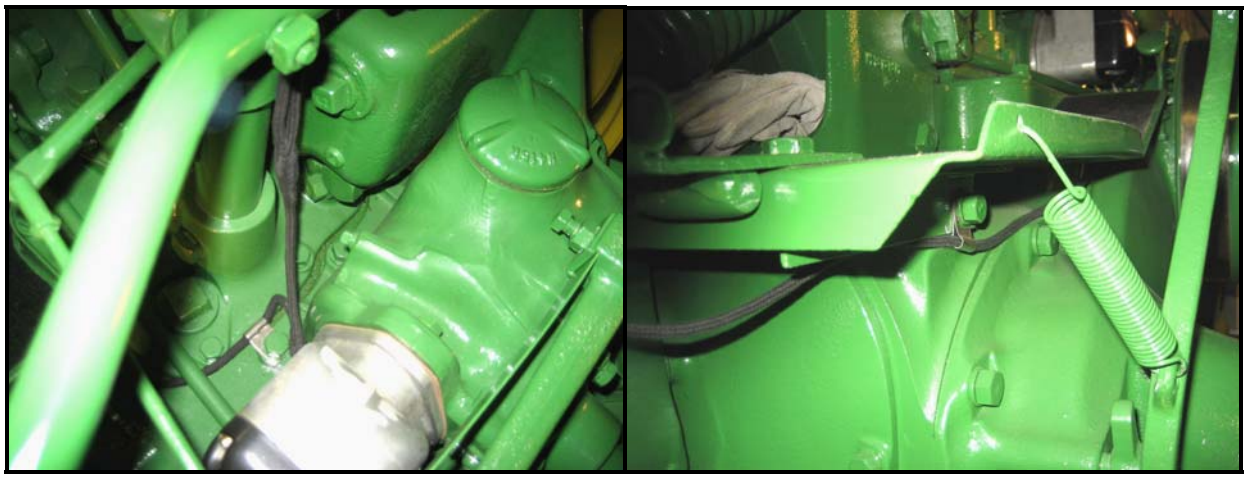


Figure 710. Battery Connections and Dressing

Lighting Harness Connections & Dressing



General Routing of Lighting Harness



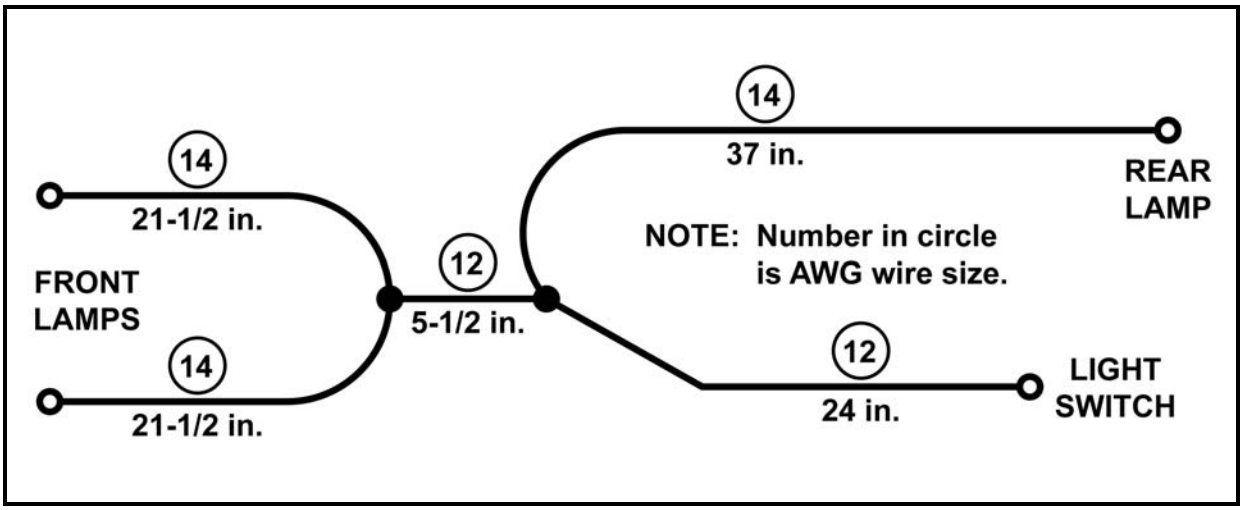


Figure 711. General Routing of Lighting Harness (Top 4 photos), and detail of the lighting harness (bottom)

Carburetors
Chapter 8

Original Equipment -- When your Model "H" tractor left the factory, it was equipped with DLTX26 from H1000 thru H26999. Beginning with H27000, DLTX46 was installed. The main difference is in the choke assembly, the "46" having a choke lever that could be controlled remotely by a small rod from the operator's panel to accommodate E-start tractors. The E-start option began at H27000. Figures 801 and 802 illustrate both carburetors, each with the choke in engine-operating position. DLTX46 can successfully be used on all model H tractors, and is listed as the JD replacement for all "H" tractors.

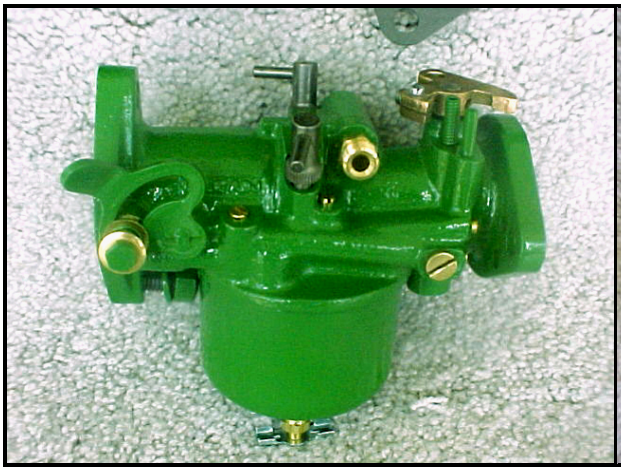


Figure 801 -- DLTX26

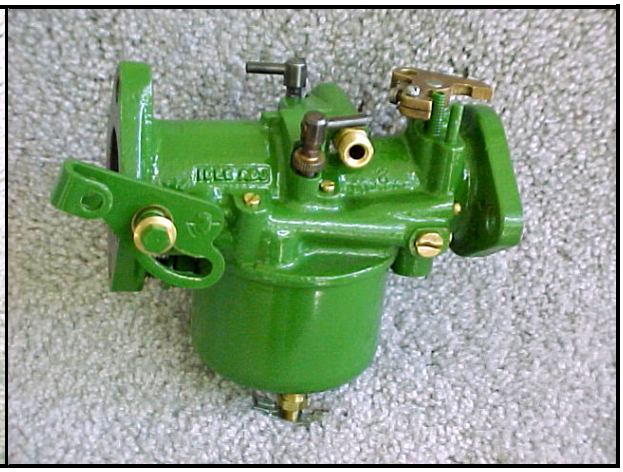


Figure 802 -- DLTX46

Universal Replacements -- Toward the end of the 1960's, Marvel Schebler/Zenith collapsed all their DLTX series carburetors for John Deere into three carburetors - the DLTX107U, designed to replace the small-bore carburetors (for the B and H), the DLTX108U for the large-bore carburetors (for the A, D and G), and a DLTX109U duplex carburetor for all the numbered series tractors. And so, locating a Model H tractor with a DLTX107U is entirely possible, and would be a welcome find indeed! This NOTE a credit to Duane Larson.

Theory of Operation

What is a carburetor? What does a carburetor do?

By definition a carburetor is a device for mixing (or charging) air and gas; specifically, a device in which air is mixed with gasoline spray to supply a vaporized, explosive mixture for an internal combustion engine. The mix is no longer plain, raw gasoline, but a more volatile gaseous compound. (Webster's Collegiate Dictionary).

About Your John Deere "H" Carburetor

Most all two-cylinder John Deere tractor carburetor bodies are made of cast iron, and this is true for the "H" tractor. They have moving parts that may have become worn, orifices clogged with old fuel, and the float may have been abused and/or may have developed a leak. The internal fuel and air passages once coated with a rust preventative, now are no longer being so protected. Thus, aside from wear to moving parts, the main body is prone to become filled with rust, clogging those air and fuel passages, and you cannot "boil" rust out.

If you started out with a running tractor, you are ahead of the game because you know the carburetor is basically functional, and you can judge its performance. While I hesitate to ever recommend a custom rebuild kit for the DLTX carburetor, such a solution may indeed be appropriate for running tractors. In general, however, I prefer to let the carburetor "tell me" what is needed. And this information is evident only after disassembly and a really close inspection of the operating parts. As an example, if with the naked eye you are able to see wear, or deformation (during your close inspection) of either of the two operating needle valve tapers (Idle or Load), it's time to renew such a needle! Another area to pay close attention to is how much "play" you find in the throttle shaft versus its two bushings. This shaft and its bushings see a lot of action, moving each and every time the governor drives the throttle. The top bushing is prone to faster wear because it is closest to the acting forces. The throttle shaft fit into its bushings needs to be very close to tight, but not a "binding" tight fit; a machinist's "snug fit." Such a close-fit is not nearly as critical with the choke shaft as we are dealing with air only on the choke side of the carburetor's venturi, and leakage here will have no effect on fuel-air mix ratios. (Note: *Venturi* is the narrowed place in the carburetor's "throat" or "barrel").

On the other hand, starting with a tractor that you haven't heard run, that may not have run for years. and is not now running, puts you at a disadvantage insofar as the carburetor is concerned. You have no clue. You are beginning with what must be assumed to be a dysfunctional carburetor. You clean and rebuild, replacing unserviceable parts as found. This approach assumes plenty of wear, and that any passageway that could be rusted shut *IS* rusted shut; and you proceed from this point forward.

The Basic Systems of the Natural-Draft Carburetor

1. Idling System

When the throttle valve is closed, the idling system supplies just enough fuel-air mixture to keep the engine running (slow idle). The closed throttle reduces airflow through the venturi to a level that cannot

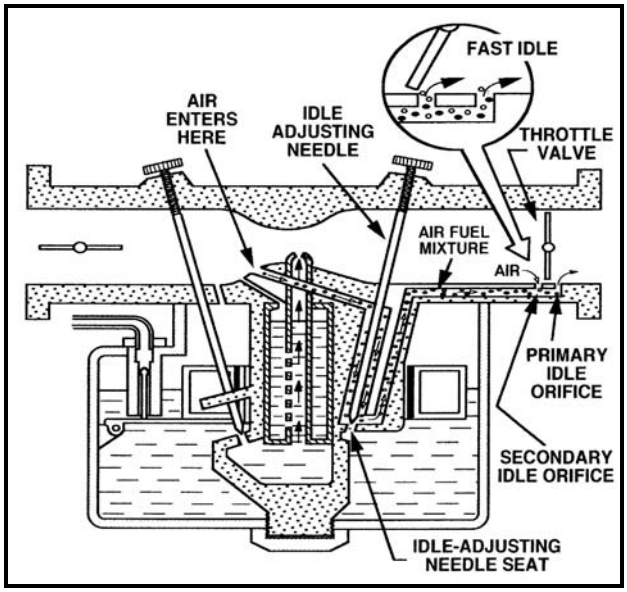


Figure 803 - Idling System Diagram

overcome the resistance to flow of load fuel up through the fuel nozzle, but also means that a fairly significant vacuum occurs on the engine side of the throttle valve. This manifold vacuum is sufficient to pull the fuel-air mixture through a series of small channels and openings that by-pass the throttle valve. Air enters through a small passage in the carburetor body at the venturi ridge (not thru the venturi) and passes across an idle-adjusting needle seat. At this point, the air picks up fuel and the fuel-air mixture is

delivered to the engine through a series of drilled passageways leading to an opening (the primary idle orifice) on the engine side of the closed throttle valve. A secondary idle orifice feeds air into the fuel-air stream, thinning down the fuel-air mixture to satisfy the slower idle requirements. The amount of fuel entering the air stream can be regulated by the idle-adjusting needle.

The manifold vacuum on the engine side of the closed throttle valve provides the needed pressure differential across the throttle valve to cause fuel-air mix to flow in that direction. The amount of fuel is determined by adjustment of the Idle needle valve. Observe that air-flow is an engine function, and is determined by the condition of the valves, piston rings, and a quality interface between the carburetor and manifold -- all this to say, "the engine's ability to draw the air-fuel mix."

The result is an entirely separate carburetor circuit (Idle Circuit) that without "help" from the LOAD Circuit, operates to feed the engine when the throttle valve is closed.

As the throttle is opened up slightly from the fully closed position, the side of the rotating throttle plate opening toward the venturi, exposes the secondary idle orifice to manifold vacuum allowing greater flow of a leaner fuel-air idle mix. And at the same time, also providing a transition to metered fuel flow through the regular open throttle (load) circuit. As the throttle is progressively opened, the manifold vacuum reduces since there is less restriction on airflow, reducing the flow through the idle circuit. This is where the venturi shape of the carburetor throat comes into play, due to the Bernoulli effect (i.e. as the velocity of a gas increases through a fixed orifice, its pressure falls). As the throttle valve closes when load is relaxed, the airflow through the venturi drops until the reduced pressure is insufficient to maintain load fuel flow and the idle circuit takes over again as described above. The engine, even with the speed control lever in its full throttle position should sustain Fast Idle by drawing air-fuel mix through the IDLE Circuit only. The engine will not, however, accelerate from Slow Idle to Fast Idle without some added LOAD fuel.

2. Load System

This system meters fuel, and delivers the proper fuel-air mixture to the engine in all governed ranges of speed and load above idling. The amount of fuel entering the nozzle is regulated by a load-adjusting needle. A carburetor basically consists of an open pipe, the carburetor's "throat" or "barrel", through which air passes into the inlet manifold of the engine. The pipe is in the form of a venturi, that is, it narrows in cross-section and then widens again, causing airflow to increase in speed through the

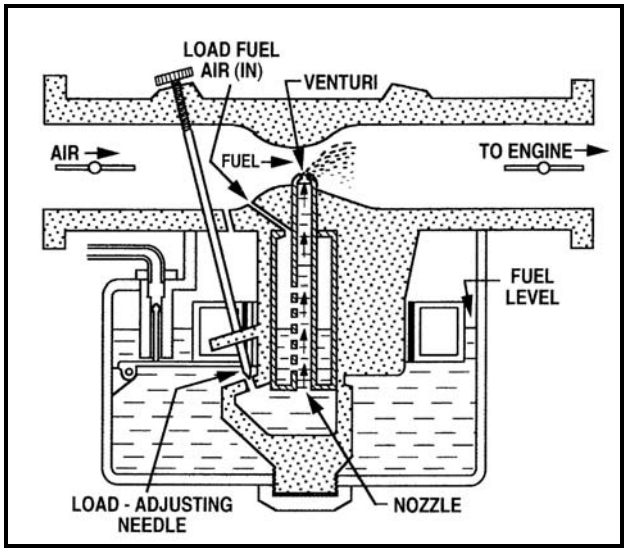


Figure 804 - Load System Diagram

narrowest part. This is where the Bernoulli principle comes to life; i.e., that moving air has lower pressure than still air, and that the faster the movement of the air, the lower the pressure. Generally speaking, the throttle or accelerator does not control the flow of liquid fuel. Instead, it controls the amount of air that enters the carburetor. Faster flow of air and more air entering the carburetor draws more fuel into the carburetor due to the partial vacuum that is created by air flow at the venturi.

The throttle valve is linked to the governor that is designed to regulate engine speed by sensing small changes in engine speed (flying weight system); opening the throttle valve as speed slows, and closing the valve as speed rises, and reaches its regulated rate.

Fuel is introduced into the air stream through the fuel nozzle positioned at the narrowest part of the venturi. The rate of fuel flow in response to a particular pressure drop in the venturi is a function of two variables, one is the load-adjusting needle valve (the equivalent to a fixed fuel jet in an automotive carb), and the other is fuel held in reserve in the accelerating well which surrounds the fuel nozzle.

3. Accelerating System

Whenever the throttle is opened quickly to give extra power for a sudden load, an extra amount of fuel is required for a momentarily richer fuel-air mixture. The inertia of liquid fuel being greater than that of air means that when the throttle is suddenly opened in reaction to a sudden load, airflow would increase ahead of fuel flow. Were this to occur, this temporary "lean" condition would cause the engine to "hesitate" or "bog down" under acceleration. In automotive carburetors, this sudden demand for a rich fuel-air mix is satisfied using a small plunger-type accelerator pump to inject extra fuel, fuel above the metered amount to cover this lean period. In this, and most carburetors used by Deere, an accelerating well provides the extra fuel.

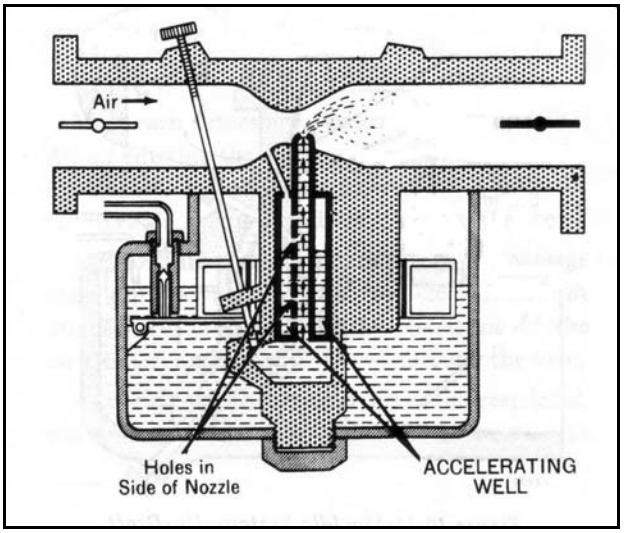


Figure 805 - Accelerating System Diagram

When the engine is idling, fuel rises inside the load nozzle and passes through holes in the side (wall) of the nozzle into the chamber, or well, surrounding the nozzle where it (the fuel) accumulates. When the throttle valve is suddenly opened, the fuel stored in the accelerating well gushes through the holes in the side of the nozzle without being metered by the adjusting needle and combines with the normal flow in the nozzle. The two quantities of fuel enter the air stream, making a much richer air-fuel mixture to satisfy the sudden requirement for more power. As the fuel supply in the accelerating well diminishes, the holes uncovered by the fuel leaving become air bleeds, satisfied by the "Load Fuel Air (in)" passage at the top of the accelerating well. After the accelerating well is drained, it remains empty until the fuel

consumed by the engine is less than the fuel flowing into the accelerating well (through the LOAD-adjusting needle), at which time it refills with this excess fuel. This occurs when the throttle returns to a 1/4 load or to fast-idle position.

4. Economizer System - A System of Pressure Differentials (Figures 806 and 830)

The economizer system retards the flow of fuel to the engine at part-throttle speeds, when full capacity of the fuel nozzle is not required. Fuel is delivered out of the main nozzle opening by a difference in air pressure at the top of the nozzle and the pressure on the fuel in the bowl. To regulate this pressure in the part-load range, a passageway is drilled from the air cleaner side of the carburetor body, through a trap construction toward the center of the body and continuing to the manifold side of the carburetor. This passage way has an opening into the bowl near the trap section (bowl vent).

Located in this drilled passageway (toward the engine manifold end), there is a calibrated economizer plug mounted into an also-calibrated annulus or channel. These work together to regulate the exact pressure desired on the fuel in the bowl, so as to provide maximum economy throughout the entire operating range. When the throttle butterfly passes the opening in the passageway, the pressure is reduced. This reduction in pressure is carried back through the pressure-regulating opening, enabling the carburetor to automatically adjust the pressure on the fuel in the bowl in accordance with engine requirements. This means that for light loads a smaller quantity of fuel will be delivered to the engine.

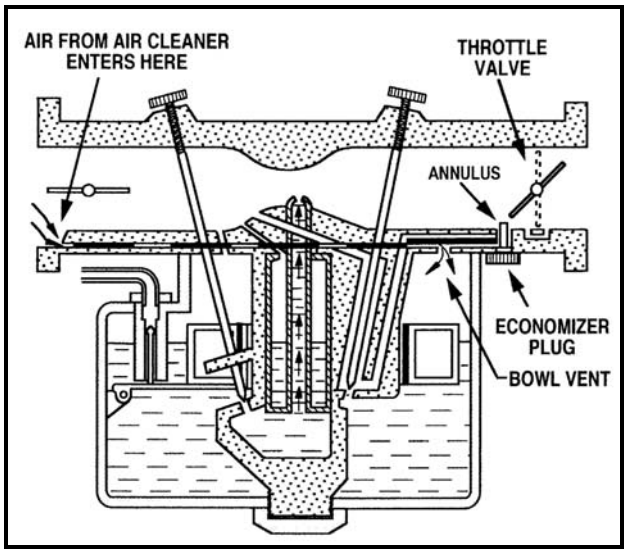


Figure 806 - Economizer System Diagram

Rough Terrain -- If you ever operated a JD-A, JD-B or JD-G tractor over rough terrain such as across corn rows while making a turn, you also probably sometimes noticed the tractor seemed to take on too much fuel, and would smoke a little and falter or miss. This is due to fuel being sloshed up into the bowl vent trap section. The fuel upset the on-going changes in air pressure on fuel contained in the bowl thus feeding excess fuel into the engine. Some would describe this as a temporarily flooding condition, and that is basically correct. In August of 1953, Deere issued instructions for modifying the bowl vent trap so as to correct this "missing of the engine" as they called it. This was pretty late in the production of these tractors, but illustrates that economizer problems were beginning to surface. See Field Service Bulletin (or FSB) No. 206, August 1953, pages 62 and 63.

Blockage, Complete or Partial -- For carburetors used on many of the A and B tractors, there are a pair of brass baffles in the bowl vent trap to allow air to pass but block some of the fuel sloshing. As in all parts of the fuel system subject to clogging by varnish build-up, these too can become restrictive. When they do, performance of the economizer system is spoiled.

Trouble Shooting -- Several factors may affect performance of the economizer system. One is a partial or full blockage of the passageway connecting the economizer, bowl vent and bowl vent-in air opening. Accumulation of debris in the annulus can alter the metering function of the annulus and economizer plug. Finally, there is the economizer plug itself. You should see a letter stamped on the plug. See the **Carburetor ID Chart** (FSB 182-S, August 1951, or www.jdhpubs.com) (to compare the letter you see with the letter listed for your carburetor to ensure you have the right economizer plug. If the letter cannot be read due to sandblasting or other abrasive processes, renewal of the plug is recommended.

5. Choke

When the engine is cold, fuel vaporizes less readily, and ignition and combustion are more difficult to sustain; thus a richer mixture (more fuel to air) is required for starting. To achieve this a "choke" is used; this is a device that restricts the flow of air at the entrance to the carburetor. This functions similarly to the throttle being closed, except for the fact that it is closed off before both idle and load circuits. Here, the low pressure caused by the restriction sucks additional fuel through both of the fuel circuits, idle and load.

6. Float Chamber

To ensure a ready supply of fuel, the carburetor has a "float chamber (bowl)" that contains a quantity of fuel ready for use. This works similarly to a toilet tank; a float controls an inlet valve. When the float drops, the inlet is opened allowing the fuel to flow into the fuel bowl under the gravity-feed system pressure. And as fuel flow causes the float to rise, this rising action closes the inlet valve.

The level of fuel maintained in the float bowl can be adjusted by bending the small tab that makes contact with the float inlet valve. This is a fairly critical adjustment -- criteria differ, but for JD "H" carburetors, we have three indicators of a "correct" float setting. Adjust so that: (1) fuel stops flowing as the float comes to a level position, (2) there is 3/8 inch between float and body casting, and/or (3) the bowl will fill to a point 3/4-inch down from its top, and then stabilize.

These floats can spring leaks and lose their floatation. Inspect float for cracks or unsoldered joints. To test for leaks, immerse the float in hot water. Appearance of bubbles will indicate leakage. Do not attempt to repair a damaged float.

The original floats were made of natural cork and were sealed with a special varnish coating. However, the varnish would eventually deteriorate and fuel would saturate the cork, making it useless as a float. Hollow metal floats were introduced in 1946 (FSB 153-S, 6-15-46). It's highly unlikely that a cork float would have survived until today! Replace cork floats if found.

Over a long period of time, the float needle valve itself becomes worn by the fuel flow and thus fails to shut off completely. This will cause excessive fuel flow and poor engine operation. Conversely, as the fuel evaporates from the float bowl, it leaves sediment, residue, and varnishes behind, which clog the passages and can interfere with the float operations. This is particularly a problem in antique tractors operated for only a part of the year and left to stand with full float chambers for months at a time; commercial "fuel stabilizer" additives are available to reduce this problem.

Diagnosing Faulting Carburetors

Partial Quote from Robert's Carburetor Repair Webpage -- "Although many things can cause your tractor to idle incorrectly, there are three passages in the carburetor that most often will not let your tractor idle well. Three passages in the carburetor idle system are 90% of the carburetor idle problems that show up on my bench. These passages cannot be cleaned out with a wire or soaked. We are dealing with rust, not old fuel. A 6-inch long # 40 aircraft drill bit is needed to run through two of the passages. The #53 drill bit is needed for the third. These drill bits will take the passages back to their original size. You will need to remove the drill plugs to do this procedure. Remove all the drill plugs, and check all passages when overhauling your carburetor."

Expanding Robert's Data Some -- The #1 passage (IDLE AIR-FUEL MIX) is located through the front of the carburetor (manifold side) and is the top 10 x 32 drill plug (# 40 drill bit). The lower drill plug of the two is a 12 x 32. The #2 passage is located in front of, and parallel to the idle adjust screw (also IDLE FUEL-AIR MIX) (# 40 drill bit). The #3 Secret Passage is located in the bottom of the carburetor stem and across from the idle needle tip (the lower leg of the IDLE FUEL-AIR MIX) (#53 drill bit). Two other smaller, yet also important passages in the IDLE SYSTEM are the final upper legs of the IDLE path; one for the fuel-air mix (PRIMARY IDLE ORIFICE), the other for idle air (THE SECONDARY IDLE ORIFICE). These are located on the throttle valve end of the carburetor, and cleaned with a # 60 aircraft drill bit (PRIMARY) and a # 57 bit (SECONDARY) respectively. Then there is the IDLE AIR IN path, a small (#53) hole on the venturi's ridge at 3:00 o'clock as viewed from the choke end of the carburetor. For absolute definitive drilling data and bit sizes (bit # versus dia.) see CLEANING in the Overhaul section.

Protecting the carburetor -- Orifices in any carburetor are specifically designed for the functions they perform. Their primary function is to meter (to mete out) fuel in the right quantities so as to obtain desired engine performance; this being true whether starting, idling, or under a load. Drilling any of the orifices with larger bits than are called for will permanently alter metering function and may possibly render the carburetor LOST! In order to ensure that this will not occur, operate these drill bits into carburetor passageways by holding them in the hand only -- it's okay to mount a small handle on the bit. Do not chuck them up in a powered drill! It is assumed that by hand you will not be able to drill any passage way or orifice larger than it was designed to be, thus protecting the carburetor.

In fact, John Deere Service Manual SM-2024 (Carburetors) has a very blunt warning about this: "CAUTION: Never clean holes or passageways with small drills or stiff wire, as a slight enlargement or burring of these holes will change the performance of he carburetor as well as remove rust preventive on passageways. There is no method of cleaning other than solvent."

However, if after 60-plus years rust has overwhelmed the factory-applied rust preventive, there is no choice but to use the specified drill bits. But use extreme care!

Troubleshooting -- Starting Problems are Most Common

"My tractor cannot hand start. Pull it down the street and it will start, and will run as long as the engine speed is up."

"I bought a recently-restored 1940 H and have not been able to get it started. The seller says it was running before he sold it. The carburetor was damaged in transit and replaced by a rebuilt one."

"My tractor won't start. Magneto snap is nice and crisp; it throws a blue spark across 1/4 inch gap, and it is firing at the right time for each cylinder. Compression is super -- near 80 PSI on each side, and to crank it saps my strength in no time! If I remove the plugs, squirt some gasoline into each cylinder, and reinstall the plugs, I can get both cylinders to fire, but will not start and run."

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These are typical complaints heard from "the community" of John Deere owners. There are others. Given three essential properties, a simple internal combustion engine as in two-cylinder tractors will usually start: (1) Engine compression, (2) Ignition at the correct time, and (3) Fuel in a moderately correct quantity.

Compression -- There is a direct relationship between compression and manifold vacuum. Low compression brings decreased manifold vacuum, which (in turn) decreases the draw of idle fuel-air mix during starting. Even if enough fuel is drawn with help from the choke, really low compression results in too little "kick" of a firing cylinder to start the engine. See "compression testing", Chapter 6.

In general, running a compression test is always a good practice to eliminate variables, and for the "H" tractor, an engine with compression readings of 50 PSI or more should start; even as low as 40 PSI tractors are out there being started and are working. A new engine is rated at 80 PSI. For a hand start tractor, one may not be able to spin the engine very fast. Thus, compression readings are likely to be lower. Perhaps equally important is that the readings be within 10% of each other.

Spark -- Verify sufficient ignition at the proper time. You should have a sharp, distinctive "snap" sound of the impulse, and a nice blue spark that will jump at least 1/4 inch! The # 1 ignition spark should occur as the flywheel L. H. IMPULSE passes its reference mark, and # 2 should occur 1/2 revolution (of the flywheel) later; as each cylinder is on its compression stroke. Make sure you have stranded metallic core wires. See **Spark testing** in Chapter 7.

Fuel -- Too little fuel makes the tractor start hard, and too much floods the engine, causing it to smoke and have very little power. Fuel tank and lines deliver fuel to the carburetor, and the carburetor is the metering device for fuel to the engine. Ensure you have fuel flow to the carburetor; then be looking for signs of either a dry, or a flooded engine.

The list here begins with debris in the fuel system causing a stoppage (Be sure to check to see that the fuel separator/fuel filter has a screen in it), a float set too low to provide fuel to the carburetor's idle needle at the point where starting fuel enters the carburetion process, and finally -- blockage of the idle pathway preventing the fuel-air mix from reaching the intake manifold.

Initial Carburetor Settings - Carburetor IDLE and LOAD needle settings [except for being all the way in (closed)] <u>are not critical</u> in engine starting. Thus, a setting of from <u>1-1/4 to 1-3/4 turns out for IDLE</u> and from <u>3/4 to 1 turn out for LOAD</u> needle is perfectly fine for an engine start. So, until you have your engine running, set them like this and forget about them! In fact, when your carburetor is set up correctly, a serviceable engine will start with no help from LOAD fuel at all. The LOAD needle could be completely closed!

A general pattern of troubleshooting begins to ensure we have **clean fuel**. Ensure your fuel filter has a functional screen, and if there is visible debris in the fuel sediment bowl, do a cleaning job. Place a suitable collector under the carburetor and observe fuel flow as you open the carburetor's drain cock. Let
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the entire bowl drain, and observe the flow rate after that point. It should continue to be a steady stream. (This is to verify open fuel lines and filters.) Sometimes a partially clogged line or filter will pass enough fuel to permit starting and idling, but will starve the engine if under a load.

Next, we want to get a feel for the **float setting**. A small device called a float level tester is helpful here; install a hose barb in place of the carburetor bowl drain cock, attach a 10 to 12 inch section of clear vinyl tube and tie (or hold) the open end up along side the carburetor. Turn on the fuel and watch the clear hose; give it time. The level of fuel showing should be approximately 3/4 inch below the top of the bowl.

Two other quick and easy checks here; (1) Back out either the Idle or Load needle and check the end for "wetting." There should be enough fuel in the bowl to wet the needle's end. This observation is more successful in the morning at highest humidity which slows evaporation of fuel from the needle taper! (2) This one, valid only for the "H" tractor, is a "volume" test. Close the drain cock and open the fuel valves to allow fuel flow into the carburetor bowl. Leave it open for a full minute. Then close the fuel valve(s), and measure the amount of fuel you can drain from the bowl. You should collect between 4 and 5 fluid ounces!

Float setting criteria -- if the carburetor's bowl were removed, this level would be achieved if the float is dead level as it closes the needle valve; a point where the float is between 3/8 and 1/2 inch below the carburetor's casting as the needle is closed. For "H" tractors, this distance is 3/8 inch.

Finally, one turns to **blockage** in the IDLE SYSTEM of the carburetor -- the source of fuel-air mix for starting. This is a very common problem with JD cast iron carburetors now some 5 of 6 decades old! Below is a "no-wrench" test that will reveal whether or not your idle (and load) systems are open. Cleaning the carb's internal passage-ways is part of an **overhaul procedure**, and if you decide to overhaul your carburetor, see the “H” Carburetor Overhaul Procedure later in this Chapter, and proceed from there. For other carburetors, see Robert’s Carb Video # 2 available from the Green Magazine Video store.

No-Wrench Testing -- LOAD and IDLE Pathways

A test is conducted to double-check your carburetor's IDLE and LOAD pathways by manipulating the IDLE and LOAD needles. Here is how it goes:

NOTE: This test involves radical adjustment of both the LOAD and IDLE needles. Before you start the engine, observe the position of each needle lever, and count the number of turns OUT that each of the two needles is at so that you can put them back where they were before this test is run.

Warning: When turning a LOAD or IDLE needle all the way in, take it gently as the needle bottoms out. Going up against the stop with too much force will damage the needle.

(1) With the tractor running at Fast Idle (full throttle – no load), turn the LOAD needle all the way in. The engine will continue to run if the IDLE SYSTEM is open, and if it stops running, the idle system IS NOT open! Assuming this test is a pass, reset the LOAD needle where is was and go on to test two below. **NOTE: This test isn't reliable for DLTX51 Carburetors!**

(2) With the engine running at Fast Idle, turn the IDLE needle all the way in. The engine will continue to run provided the LOAD FUEL system is open, however, in this mode, engine operation will be a throttling pattern. As engine speed drops, the governor will open the throttle to draw LOAD FUEL because the idle path is closed. This pattern, however, indicates the LOAD FUEL channel is open and working as it should. If the engine stops running, the LOAD FUEL channel is obstructed.

From Others in John Deere Land

Note -- whereas the following are of actual cases, and of actual remedies proposed, there may be duplication in text from one to another, this in the interest of providing data as it was developed.

1. "John Deere "H" Won't Start; Fuel Leaking at Manifold"

Fuel leaking between the carburetor and manifold shouldn't be! This is indicative of a poor gasket seal. Listen really close (at this joint) for any hissing or sucking while engine is being cranked. If yes, try some kind of copper-based gasket sealer; and be careful not to strong-arm those bolts. You really do not need stripped threads in you manifold. See "gasket sealers" in Chapter 3.

Without disconnecting anything, try either the "wetting" test, of the "volume" test as a quickie check on float and needle valve operation.

Float level tester -- The best way to check float and needle valve operation is with a Float Level Test Kit. With the engine not running and fuel valves open, fuel should rise in the carburetor's bowl to a point 3/4 inch down from the top of the bowl. Monitor for 15 minutes or more. A leaking needle valve will quickly be noticed as the fuel level continues to rise above the set point.

Now for some analysis -- Based on your earlier comments of too much fuel, there could be some debris preventing the needle valve from closing or the float is set too high. For either you will need to unbolt the carburetor's bowl. Use a crisp 5/8 inch box end wrench, and be gentle! Have a catch basin for fuel. If there is some junk keeping that needle from closing, your best hope is to use a flow of fuel to flush it out. This allows the float to be in a lowered state thus opening the needle valve. Gently raising the float should close the needle valve and fuel flow should halt.

It just may be that you will need to pull the small pin holding the float in place and when the float comes away, the needle will fall too -- be aware -- don't lose it! Whether or not you have to drop the float and needle will depend on what is keeping the needle valve from closing, and whether or not the problem clears without removal. A small mirror may be useful here.

CRITERIA: As the float is gently raised, the needle should come to a close as the float is DEAD LEVEL, or as it is 3/8 inch below the carburetor's main casting. If the needle is working but closes at some point different from this criteria, gently bend the tab on the float that closes the needle valve to achieve cut-off at 3/8 inch below the casting, or at the float being in a DEAD LEVEL position.

Be careful when reinstalling the carburetor's bowl. Don't cross-thread the bowl fastener, make sure the little spring is there to hold the fuel nozzle in place. Examine both gaskets -- the large bowl gasket, and the little one for the bowl bolt. When tightening the bowl nut, avoid the gorilla syndrome. Bring the nut snug enough so that the bowl doesn't rotate, and then an additional 1/3 turn, 1/2 turn maximum!

By now you know the initializing settings for the Idle and Load needles on the carburetor! Set the Idle roughly 1-1/2 turns out, and the Load roughly 1 turn out. Careful! When turning the needles in to their stop, don't apply very much torque -- needle damage may result. Contrary to wide belief, the initial settings on your carburetor aren't critical for starting the engine.

2. "B John Deere Floods, Huffs & Smokes"

My first inclination was to see if the bowl vent was open. Folks are learning about drilling the idle path to see that it's open but there's been little emphasis in recent posts on the FUEL BOWL VENT. Before chasing that one let's try some less invasive things first.

1. Remove the air cleaner (oil) bowl. If problem clears up, the engine air IN path is obstructed.

2. Run the LOAD and IDLE Path Tests.

3. FUEL BOWL VENT -- As I recall, the bowl vent in that carburetor contains two small brass baffles. Only one is visible until you remove it, and then once debris is removed a second one is exposed. [NOTE: These baffles are not present in the DLTX-26 and -46 carburetors used on the JD H tractor. Over rough terrain, they prevent fuel from being in the bowl vent path, temporarily decreasing air pressure in the bowl, which (in turn) decreases the amount of load fuel available to the engine. The baffles in the vent cavity corrode shut over time, and must be opened and cleaned as part of clearing all the drilled passageways. It is often necessary to use needle-nose pliers and perhaps even a small punch or chisel to get them out. Yes, they are easily ruined in the process of removal.

3. "Starts Okay But '*Pulses*' Constantly"

'48 B starts great but when the choke is fully released it pulses constantly. It won't stop pulsing until I put the choke on one third of the way. I tried to adjust the needles but that doesn't seem to make much difference.

By heavy choking and some throttle, the Idle path can be by-passed so as to provide sufficient fuel-air mix to both start and run the engine. Electric start can appear to 'overcome' blockage in the idle path during engine start. The "pulsing" referred to here is interaction between the governor and throttle. Having, for instance, the throttle lever set at half of full throttle (fast idle), the engine will run until it slows some because it lacks IDLE fuel, and the governor sensing decrease in RPM will open the throttle thus bringing in another burst of LOAD fuel, restoring engine RPM. Once burned, the engine will again slow and in turn the governor will open the throttle again, etc.

This is a classic case of a closed IDLE air-fuel path! *Run the LOAD and IDLE Path Tests.*

One would have this type of operation with a fully functional carburetor if, while at half-throttle, you were to close the IDLE needle. This is a test of the LOAD fuel path in a carburetor. Alternately, again with a fully functional carburetor, while at half-throttle, closing the LOAD needle tests the IDLE fuel path. If closing the LOAD needle has no effect on the engine running at half throttle, the IDLE fuel path is open. Alternately, if the engine were to stop running when closing the IDLE needle, the LOAD fuel path is blocked; and if the engine stopped running when the LOAD needle was closed, the IDLE fuel path is blocked.

4. "Gas in Oil"

"Just starting to restore my 1950 B. 'Rebuilt the carburetor, and tonight drained all the old oil out of the whole tractor. Everything went smoothly until I drained the crankcase. It was quite runny and smelled like gas. Anybody have any ideas what this could be?"

This case is as classic as they come because it often takes a John Deere a day or two of solid working for the new needle valve and seat to "work in." These two aren't the best in the world at holding back fuel over the long haul anyway, thus the reason for shutting the fuel supply off to a standing tractor. But having just overhauled the carburetor, the needle valve and seat combination will require some time to "groove in". This isn't always the case, but is quite to be expected!

5. "Tractor Engine is Flooding"

"Raw fuel is present at the carburetor. Tractor starts but seems to be overcome with too much fuel and has no power."

Excess fuel problems could be a sticking float problem, a leaking needle valve and seat, a carburetor bowl vent problem, a clogged air cleaner; and in many cases, accumulated corrosion in and around the fuel nozzle.

1. A first and easy test is to separate the air inlet elbow from the carburetor intake. A next procedure would be to check the float level setting. With a suitable collector under the carburetor, remove the bowl and check float and needle valve operation.

2. When examining the float, be mindful that the float should contain air only. If it is leaking and fuel has entered, it will be heavier (less buoyant), thus allowing excess fuel to pass the needle valve. Ensure float level setting meets the criteria set above; that fuel flow thru the needle valve should cease as the float rises to dead level, or between 3/8 and 1/2 inch below the carburetor casting. (Setting is 3/8 inch for "H" Tractors). Use of a float level test kit is recommended.

3. If these steps fail to clear the problem, a clogged fuel nozzle or a blockage in the bowl vent system (bowl to the carburetor intake) remain to be checked.

a. Pull the fuel nozzle; then clean and clear all of the little holes along the side. Do your best to clean the cylindrical area up into which the fuel nozzle fits. There is no significance in which direction the small holes in the fuel nozzle point to. Be sure during reassembly to install the spring to hold the fuel nozzle in place. It fits into the bowl nut.

b. Ensure you have an open air path (carb bowl vent) between the bowl cavity and the choke area of the carburetor by removing the air intake elbow to make room for a small drill bit (9/64 inch for "H" tractors). This opening is at roughly 4:00 o'clock as viewed from the carburetor's intake end, and is recessed into the side wall of the carburetor body.

6. "Engine Starts & Idles, But Has no Power"

"Tractor starts and idles okay but WILL NOT take a load without spitting and sputtering and huffing lots of black smoke out the stack."

Found bowl vent rusted as shut as one could be! Once cleared, tractor exhibited power not seen in years.

7. "Starts, Runs, But IDLE Needle 3 Turns Out"

Engine starts easy, idles very good, and engine is responsive to setting of the IDLE needle, but when set for best engine operation, the IDLE needle is set at THREE TURNS OUT.

Found damaged idle needle -- groove or ring cut into taper -- either worn or damaged by turning in too tight.

IN SUMMARY -- The big three elements of engine starting and running are compression, fuel and ignition. Compression is a function of valve operation and rings. Fuel is a proper fuel-air mix in moderate amount (not so much that the plugs are bathed in gasoline). And ignition is a clean, snappy blue-hot spark at the right time.

OPERATING TIP

Start Engine With Nearly Closed Throttle

Most tractors start easily, however, there are those one of two in a hundred that give trouble. In most cases, these can be improved by placing the throttle in an almost closed position.

The higher velocity of air entering at the edges of the throttle disk helps to vaporize the mixture of fuel and air and keep it in a volatile state for starting.

With the throttle nearly closed, the amount of air-fuel mixture entering the cylinder is limited, lowering the compression.

With lower compression, the spark will more readily jump to gap at the spark plug electrodes; battery load is decreased, causing a hotter spark; and cranking rpm is increased (FSB 200-S, February 1953). This technique works equally well for hand-start models -- seems to help avoid flooding. ++++

DLTX26 & DLTX46 Carburetor Overhaul

~~The Procedure, Part 1~~

The difference between DLTX26 and DLTX46 is in the choke assembly. The change from 26 to 46 was driven by an electric-start option that began with serial number 27,000. The DLTX26 choke lever is designed for manual operation, and the DLTX46 for operation by a remote control rod. Either carburetor is fully functional on a hand start tractor, but the '46 is needed for a tractor with electric start so the choke can be opened and closed from the operator's seat.

While I include a section called "**Inspection and Repair**," one is advised to assume a super detective role from the beginning through to final assembly and test. If worn or damaged parts are detected at any point along the process, make note of the concern in a journal from which to prepare a procurement listing. Rather than purchase what others may call a carburetor rebuild kit, I heartily recommend you allow the carburetor to "tell you" what replacement parts are needed, and then purchase only those. One obvious need for any carburetor overhaul will be a full gasket set. The other need (not-so-obvious) is a complete (new) set of brass drill plugs.

Handtools and Work Area -- The prudent man will ensure tools are sharp, well-maintained and clean. Screwdrivers (in particular) must fill the slot in the screw and not be tapered on the end like a chisel from more wear than care! Wrenches should have sharply defined wells and flutes, no "rounding" that would promote slippage on a poorly-defined nut or bolt or fitting. Prepare an area free of clutter in preparation for these well-defined operations. Establish and maintain control. This means to avoid losing delicate parts and keep foreign matter away from the carburetor at all times. During final assembly, for instance, I like to work over a large bath towel or similar pad.

DISASSEMBLY

1. Mount Carburetor -- Fabricate a holding jig similar to the one shown in some of the pictures that follow.

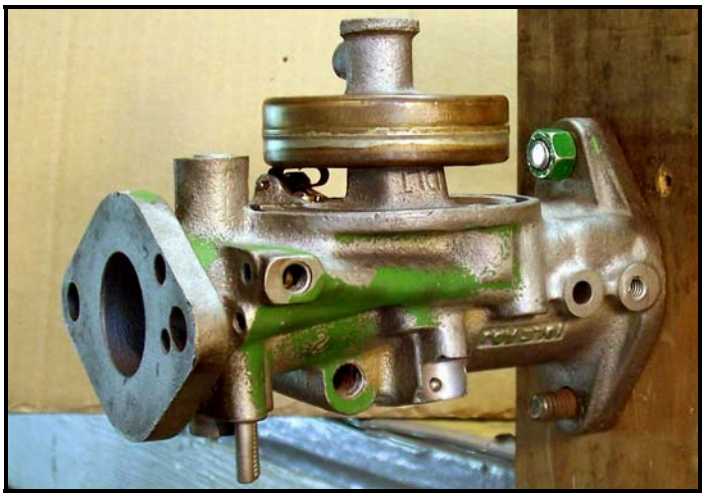


Figure 807 - Carburetor "Right" Float Setting

2. Remove Carburetor Bowl - remove bowl retaining nut, gasket and nozzle spring. If the bowl does not come off readily, tap it lightly with a soft hammer to loosen bowl gasket. Remove and discard the bowl gasket.

3. Remove Float -- Pull out float level pin and remove float.

4. Remove Float Valve and Seat -- Turn the carburetor right side up and let the float valve drop into hand. See Figure 808. In theory, apply heat to needle valve (to the brass only), then quickly cool -- now with a wide-bit screwdriver, remove the float valve seat. However, in most cases I've experienced, the valve seat ends up being drilled out; and then CAREFULLY chased with 3/8-27 tap. **CAUTION**: 1/8-inch NPT taps are tapered. And so if NPT tap is used, be very, very careful not to over-sized this tapped hole!! Remove and discard needle valve gasket.

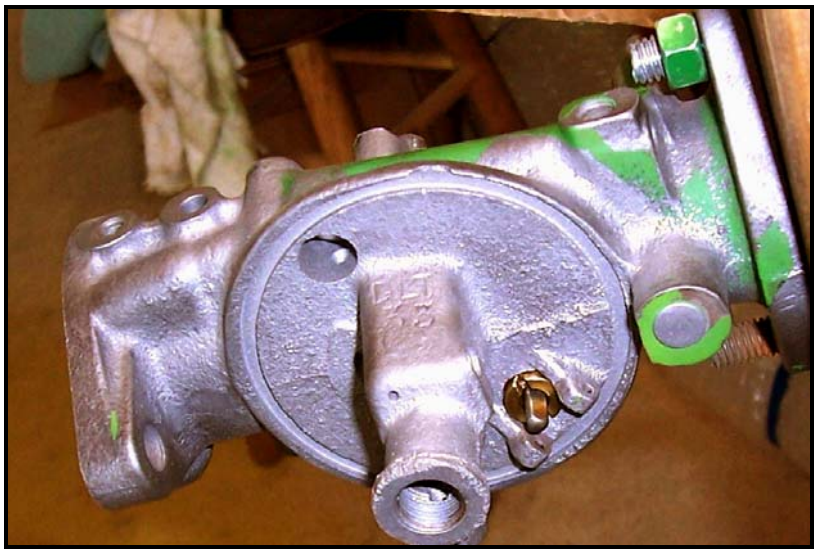


Figure 808 - Float valve and seat with float removed

5. Remove Throttle Disk -- remount carburetor top-side up. Place throttle disk in a closed position and check for wear on disk and carburetor body, and a burred or distorted disk. Remove machine screws securing disk to throttle shaft, open throttle wide and pull disk out. Worn disk is usually indicative of worn throttle shaft and throttle shaft bushings. See Figure 809.

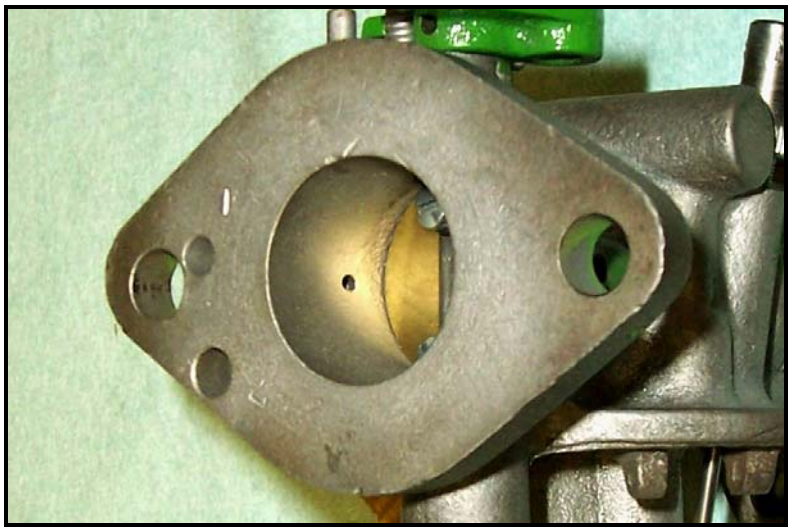


Figure 809 - Closed Throttle Valve - Only Primary Idle Orifice is Exposed

6. Throttle Shaft -- at this point of disassembly, check the throttle shaft and its bushings for wear. If shaft can be moved sideways a considerable amount, the shaft or bushings, or both should be replaced. To remove the throttle shaft from the throttle lever, remove (fully) the special throttle shaft retaining screw.

7. LOAD and IDLE Needles -- screw load needle and idle needle out of carburetor body. Inspect very closely the tapered portion of each needle. If your eye can discern any indentation from either wear, or over-tightening of the needle into its seat, replace the needle.

8. Fuel Inlet Strainer -- using a socket wrench with 1/2" deep-well socket, remove strainer assembly from carburetor body.

9. Throttle Stop Spring -- Inspect throttle stop spring for distortion or bends. If spring is damaged or bent over, force it out of bore in body with pliers -- for replacement.

10. Throttle Shaft Bushings -- Usually, the bottom bushing is not nearly as worn as the top one, this is because the top bushing bears most of the load during throttling motion driven by the governor. To remove bushings, first remove disk and throttle shaft, if they haven't already been removed. On the "H" carburetor, the lower throttle shaft bushing is the solid end type. Drive it out with a suitable driver inserted through the upper bushing. To remove the upper bushing, first run a 5/16-18 tap into the bushing, then use 5/16-18 threaded rod with a slide hammer to drive bushing out, not into the carburetor body. Driving the bushing inward for removal may result in chipping away of the casting thus affecting throttle disk interface with carburetor throat.

11. Choke Assembly -- Remove choke screw, washer, spring and friction washers, and turn choke lever far enough for inspection of the reverse side of choke disk. If spring is damaged so that it will not securely hold the plate covering the opening in the choke disk, a new spring will be needed. If the cover plate is damaged such that it will not cover the oval opening in the disk, replace with entire choke disk assembly. Remove and replace disk in like manner if it is burred or distorted.

12. Remove Fuel Nozzle -- this task is not that hard. What tends to make it difficult is the build up of rust not only around the nozzle, but also under it in the path it must take to come out. Perhaps you can either bead-blast or scrape some to remove the rust that is in the path of the nozzle as it is withdrawn. DO NOT attempt to push it out from within the carburetor throat as this action may render the precious nozzle useless. Two methods are described. See Figures 810 and 811.

Figure 810 - Remove Nozzle with Slide Hammer.

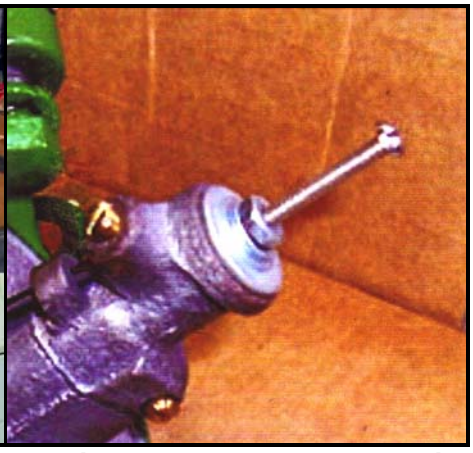


Figure 811 -- Remove Nozzle with Bolt, Nut & Washers

Method 1. Here is used a dent puller/slide hammer tool. Go into the bottom of the fuel nozzle with a 6-32 tap. Run the tap down in there just enough to get a bolt into the nozzle far enough to where it won't pull away. Insert 6-32 x 1" machine screw into end of tool, then turn screw into nozzle. Screw end of tool

onto slide hammer and pull nozzle out of carburetor bore with a knocker (slide hammer) action as shown in Figure 810.

Method 2. A second way to extract the fuel nozzle (not illustrated) is to go into the bottom of the nozzle with a tap, one that will just go into the hole (6-32 for "H" Carburetors). Run the tap down in there just enough to get a bolt into the nozzle far enough to where it won't pull away. Then take a bolt, run a nut up on it, and then a couple washers - washers with larger diameter than the carburetor stem diameter -- screw the bolt up into the nozzle threads you just made. Then run the nut down onto the washers to take up the slack. Now with a wrench in one hand and your finger on the tip of the nozzle, begin to tighten down on the nut. You should begin to feel the nozzle withdraw from the carburetor's venturi with your finger. Now if you are cranking the nut down but the nozzle isn't moving STOP. You are "pulling out" of the threaded zone in the nozzle. I like to run the tap into the nozzle by a half inch to preclude this concern. And to improve your chances for success, allow some PB Blaster or Kroil to penetrate the nozzle region for several hours up to a whole day before the withdrawal procedure. See Figure 811.

Method 3. And then there is the "carby-on-the-barby" method. Fully disassemble the carburetor down to but short of removing the fuel nozzle. Start a fair sized charcoal fire in the BBQ, and when the coals are aglow, nestle the carburetor in their midst and heap remaining coals around and over the carb body. Close the door (if your BBQ has one) and let it burn out. The next day, the fuel nozzle should near about fall out! This method comes to us courtesy <http://www.ytmag.com/jd/wwwboard1.html>, and from others.

13. Brass Drill Plugs – Drill plugs are installed to close holes once needed during initial build in order to drill passages in the casting. Their removal is essential to grant direct access so you can clear (reopen) these passages as a vital part of cleaning. As certain as one can be, these plugs are not going to just "jump out of their threaded sockets!" A well-fitting screwdriver and getting the plug super hot followed by a quick cool-down works wonders; they are key to success here. Heat, cool and remove only a pair at a time. See Figure 812. The recommendation is to install all new brass drill plugs during final assembly. Make a note to procure the set of seven.

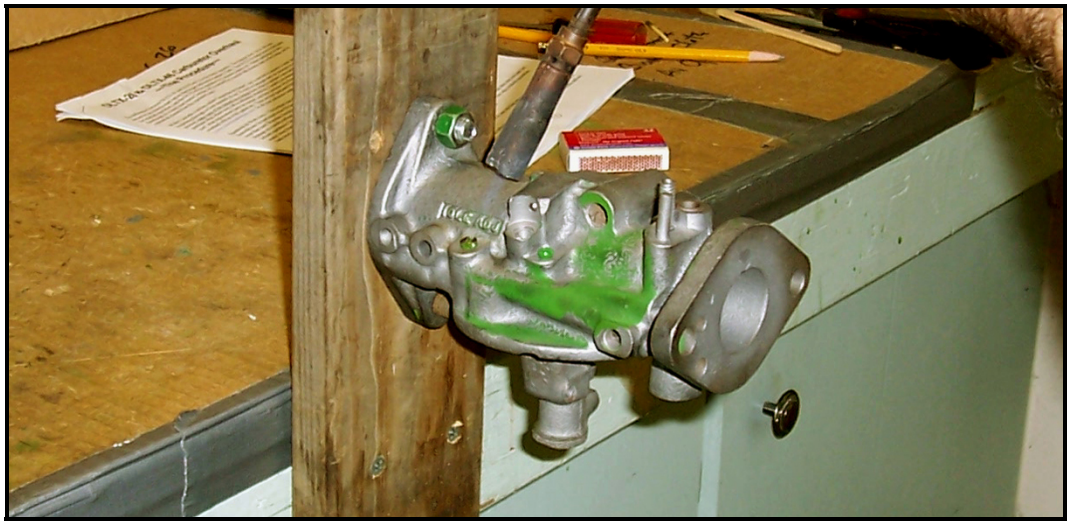


Figure 812 - Using Torch to Heat Drill Plug

With the exception of the economizer plug, these plugs seal the openings of the various passageways. Observe that all brass drill plugs aren't of equal size. Make at least a mental note for final assembly.

CLEANING

14. Three Main Steps -- Cleaning of this carburetor, now some six decades old, is accomplished in several phases or steps -- (1) Submersion in a carburetor cleaning solution (not in an acid bath) followed by rinse and dry with compressed air, (2) Glass bead blasting (not sandblasting), and (3) Controlled cleaning of holes and passageways with specific-sized drill bits driven only by the hand (not a powered drill).

15. Acid Bath Cleaning and Electrolysis -- These processes remove paint, rust and grime, but also removed is any remaining base protective and etch applications to the casting during initial manufacture. The result is an instant propensity to rust, inside and out! Sand blasting will provide a similar result because it cuts away metal as well as paint and rust. Recommended is a carburetor cleaning kit that can be followed by water cleanup such as "Chem-Dip" by Berryman, and I found my one-gallon size at an O'Reilly Auto Parts Store for a very reasonable price. See Figure 813. I rather imagine these are widely available at many auto parts outlets. Once finished with the cleaning kit, blow parts dry with compressed air. Then use glass bead blast for removal of stubborn rust from selected parts. John Deere Classic Green paint may (later) be applied directly to the glass-beaded carburetor body and bowl without a primer coat because, again, the basic primer etch properties have been maintained.

SINCE 1918 Berryman
CHEM-DIP
CARBURETOR
AND
PARTS CLEANER
★ CLEANS ALL METAL PARTS
★ FAST ACTING - NO AGITATION
★ NON-CORROSIVE TO METAL
★ CHEMICAL SEAL PREVENTS EVAPORATION
DANGER: COMBUSTIBLE MIXTURE. HARMFUL OR FATAL IF SWALLOWED.
CAUSES EYE AND SKIN BURNS.
Read carefully all warnings on rear panel.
PELIGRO: DAÑINO O FATAL SI SE INGIERE.
MIXTURA COMBUSTIBLE. LEA CON DILIGENCIA TODAS LAS ADVERTENCIAS
NET 96 fl. oz.

Figure 813 - Chem-Dip Can and the Basket

16. <u>Use Caution!</u> In the early years, the rust preventive applied to the small, winding passageways combined with a vigorous cleaning with carburetor as outlined above was sufficient to clear all passageways. Deere Literature specifically cautioned against cleaning these out with drills or stiff wire, saying "there is no method of cleaning other than solvent!" The reason, of course, is that the chance of enlargement or burring of these holes would change carburetor performance; and maybe degrade performance to a point of rendering the carburetor useless! See Fig 815, sandblasting -- Yuck!

17. Some Six Decades Later

Rust is winning the battle for residence in the carburetor's fuel and air passageways because rust preventive applications have broken down. This is making it necessary to resort to controlled drilling to clean each path to restore performance. For the delicate passageways of "H" carburetors, five sizes of drill bits come into play, and they are (a) # 40 which is 0.098" diameter, (b) # 49 which is 0.073" diameter, (c) # 53 which is 0.0595" diameter, (d) # 57 which is 0.043" diameter and (e) # 60 which is 0.040" diameter. It is entirely possible to get by without the # 49 drill bit, using instead the # 53 that is only slightly smaller. Additional drill bits, common ones from your ordinary stash, are used to clean the bowl vent, raw fuel channel, and the main stem reserve fuel cavity.

The four or five recommended drill bits (the numbered ones) are commonly dubbed "aircraft bits" that are customarily either 6 or 12-inches in length. The two smaller ones may not come longer than 6-inches. I often see sets of them offered at on-line auctions. The problem here is these offerings try to appeal to the broadest audience; this does not include the "H" carburetor! So be careful! Now, for your drill bits, either procure or make a small handle for each one. Pictures below will illustrate the use of handles, and show homemade ones that needed to be glued to give the operator the control needed. See TIP below.

TIP -- See Figures 840 and 841 (end of chapter) for alternate methods of grasping drill bits by use of a small tap handle, pin vise, and/or a double pin vise.

18. Pre-drilling Orientation -- Observe the physical arrangements at each end of the carburetor and also the throttle lever. Observing the intake end of the carburetor, we see three small places for air to enter. They are, (1) Bowl Vent Air (in) -- the larger of the three which is recessed into the sidewall of the carburetor body, (2) Idle Air (in) -- a smaller (size # 53) hole at roughly 3 o'clock on the "venturi ridge," and (3) LOAD (fuel) Air in -- the slightly larger hole (size # 49) at roughly 6 o'clock on the "venturi ridge." See Figure 301.

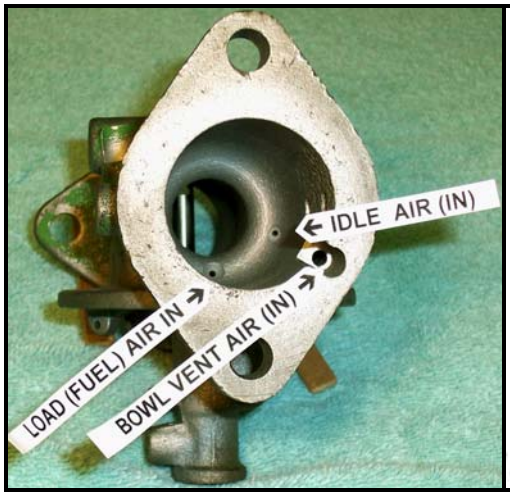


Figure 814 - Intake End of Carburetor.

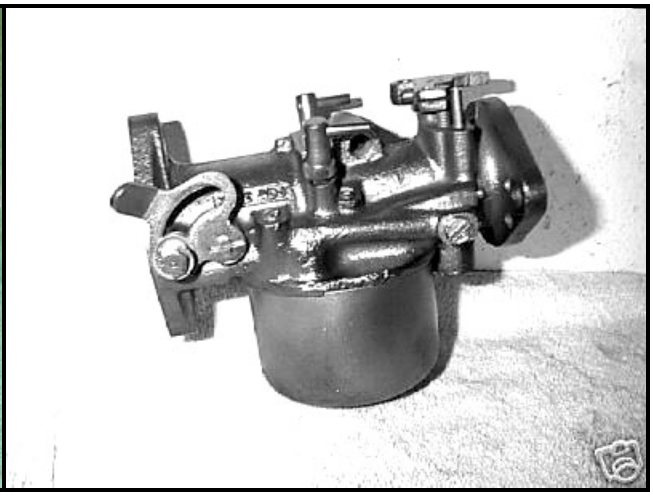
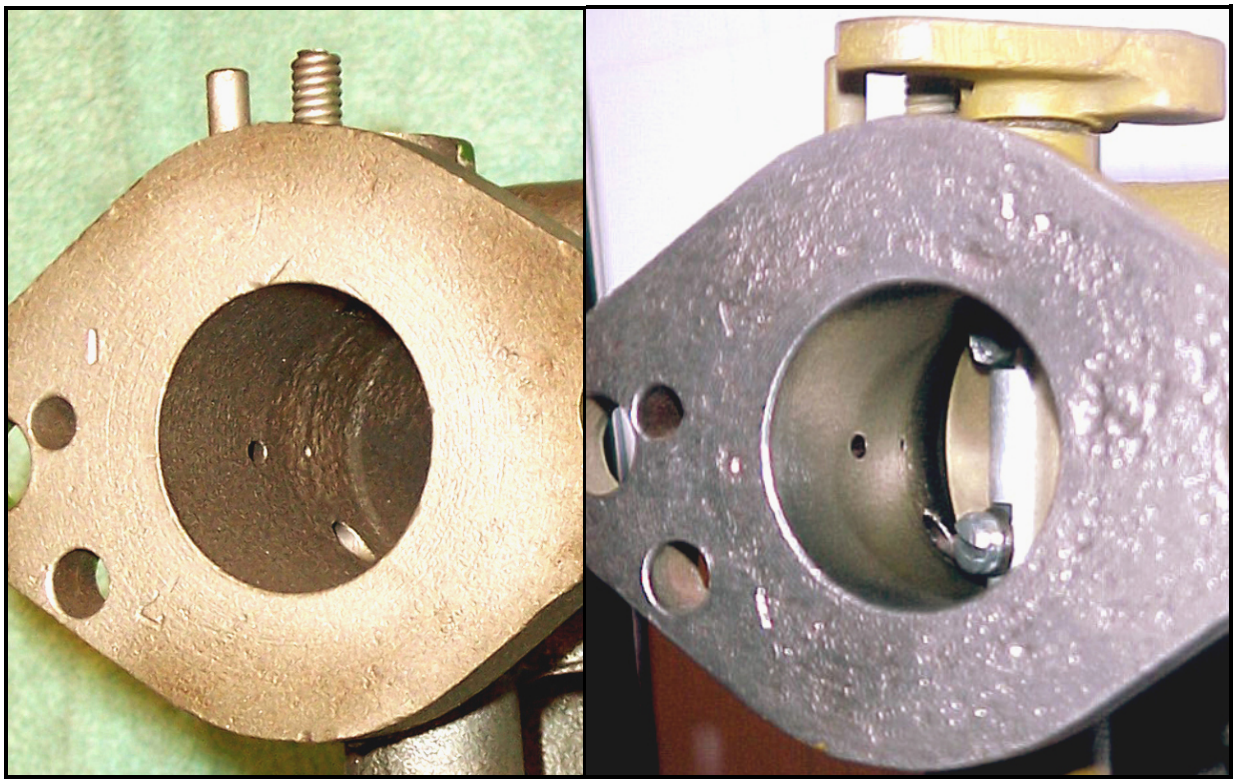


Figure 815 - Sandblasted Carburetor



Figures 816 & 817 - Primary & Secondary Idle Orifices

Figures 816 and 817 (two views, throttle plate installed on the right) -- Looking in at the manifold end of the carburetor, we observe the Primary Idle Orifice (left) and the Secondary Idle Orifice behind it (smaller one). See also the Economizer opening (lower left, just left of the lower machine screw holding the throttle plate in throttle shaft.

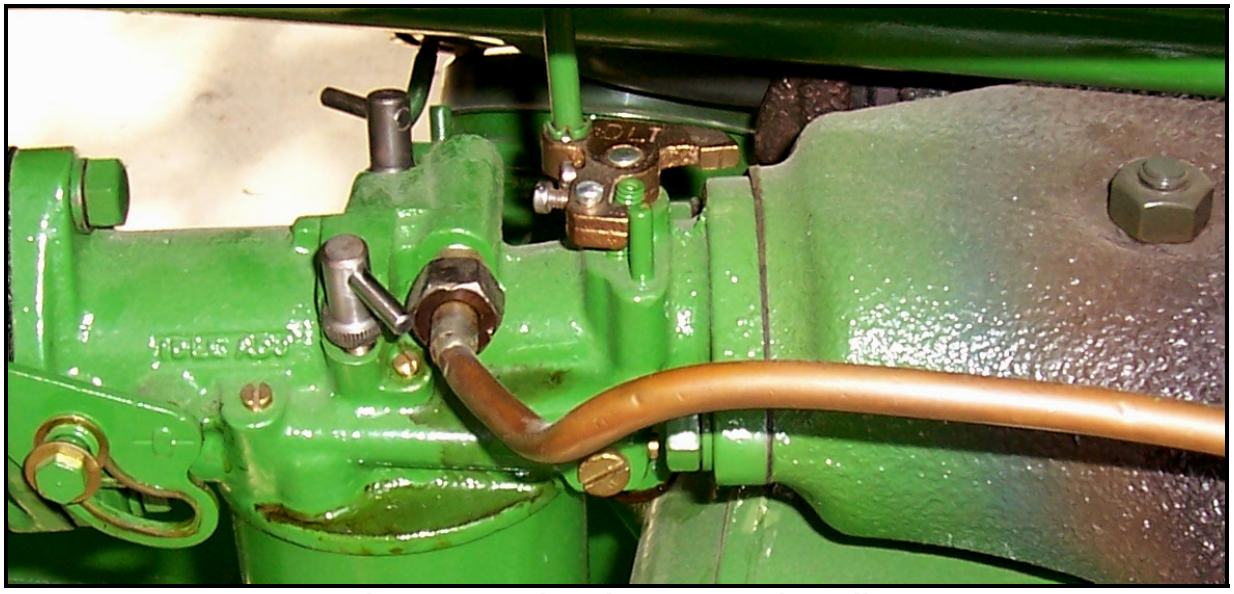


Figure 818 - Throttle Lever at Slow Idle

With the engine running at slow idle, the throttle plate is CLOSED in the carburetor body, as in Figure 809. The throttle valve is situated between the Primary and Secondary Idle Orifices when in the closed position (Figure 809), and the throttle lever is shown in the Slow Idle (closed) position in Figure 818.

19. Clearing Idle Path -- The following five pictures illustrate using drill bits to clear the idle path passageways, segment-by-segment.

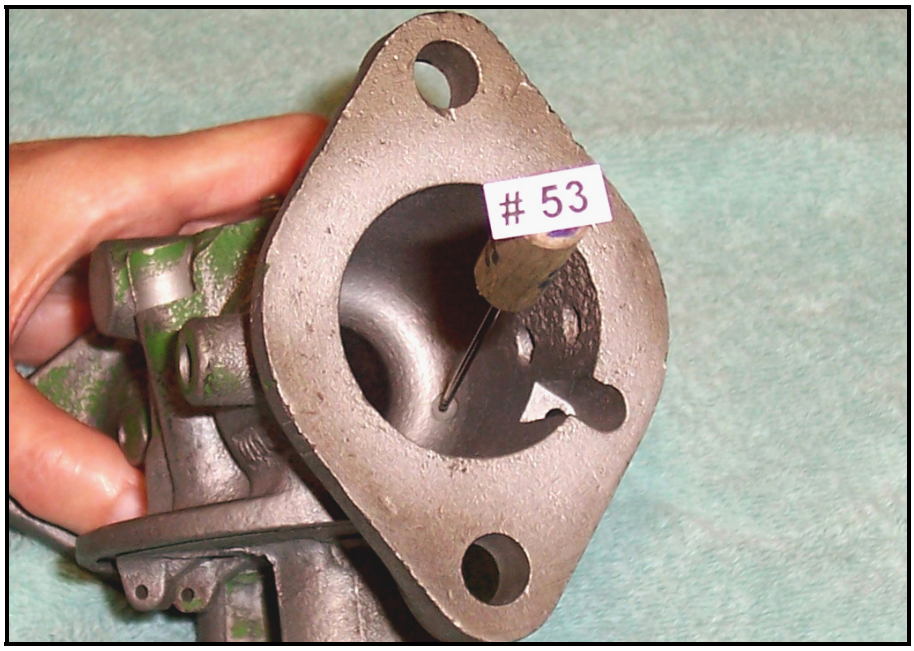


Figure 819 - Drilling Idle Air (in)

In Figure 819, we use a # 53 drill bit, and drill until the bit enters the vertical cavity down through which the IDLE needle goes. You will see the bit enter -- looking down into that channel.

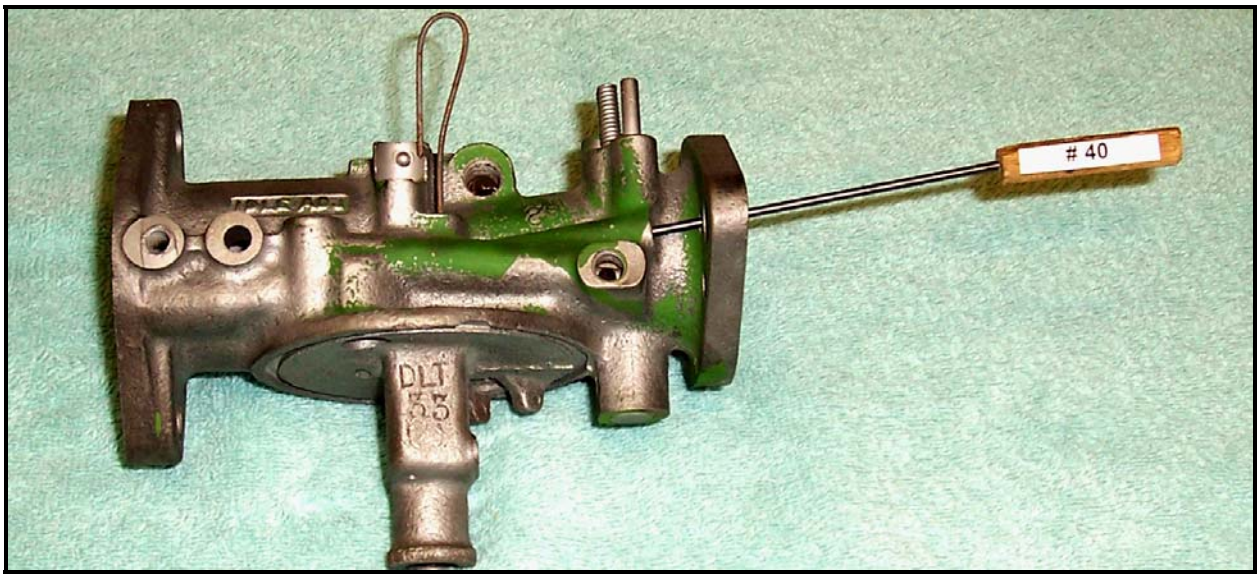


Figure 820 - Drilling Idle Path-1

Figure 820 illustrates the first of two uses for the # 40 drill bit. This is the upper passageway of two entered through the manifold flange of the carburetor. Drill back as far as you see the wire inserted for reference. The reference wire is inserted into "Idle Path-2," down along side of & about 1/4" before the Idle Needle cavity, and you should see it "wiggle" when encountered by the drill bit shown.

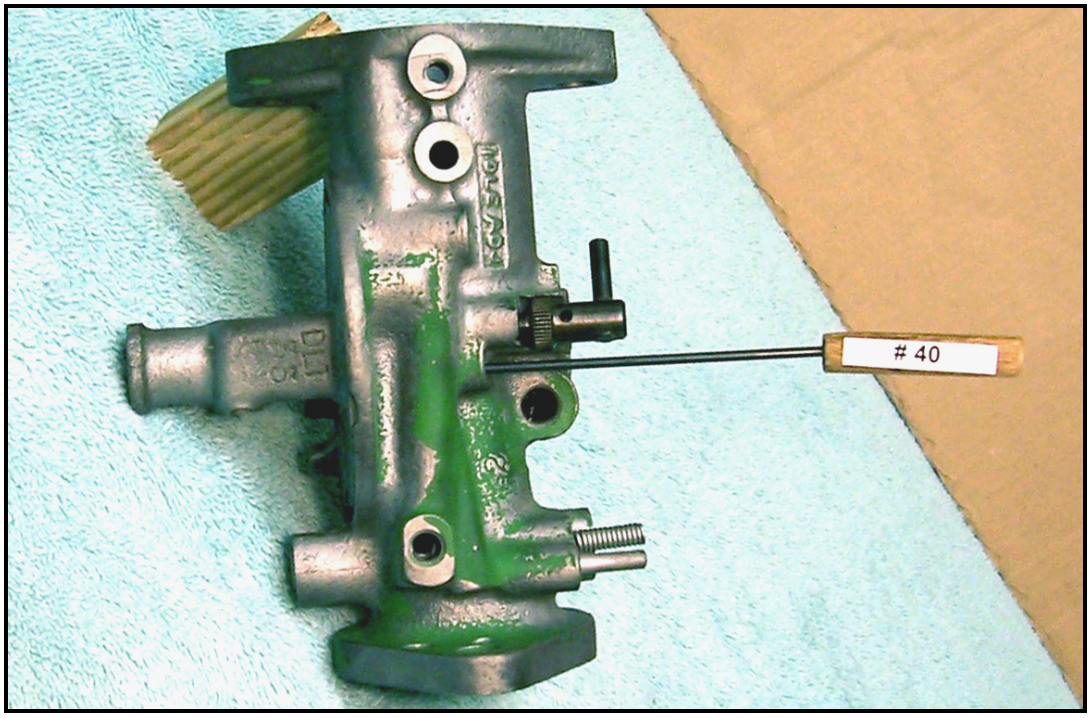


Figure 821 - Drilling Idle Path-2

Figure 821 illustrates a second use of the # 40 drill bit is used in the passageway down along side of Idle Needle. Again, looking into "Idle Path-3" (Secret Passage), you will see the tip of the drill bit when it is down deep enough to clear this of the Idle path.

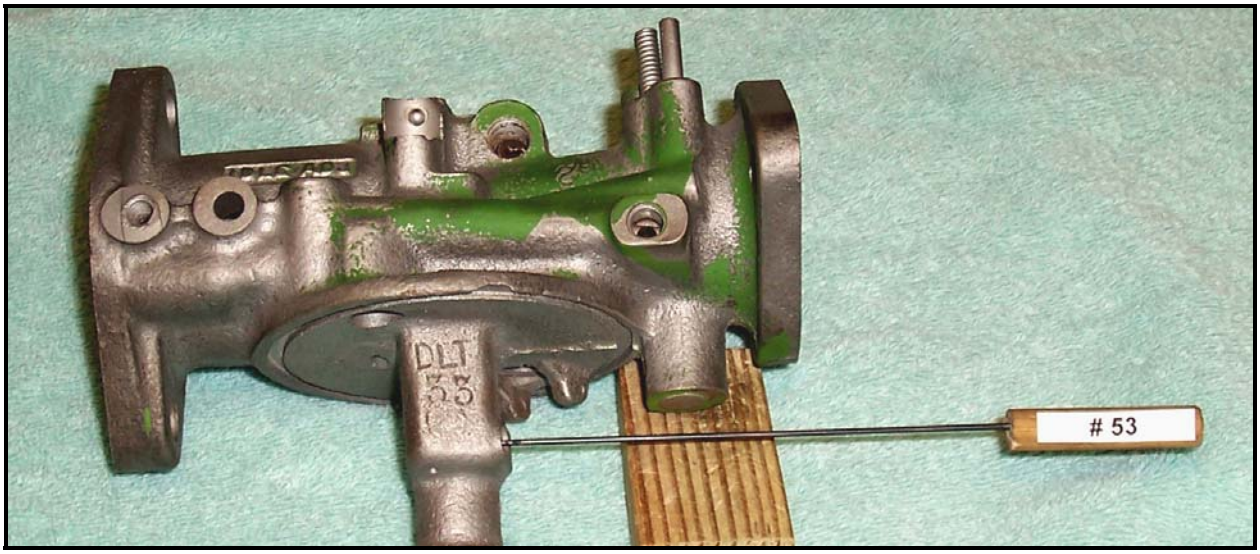


Figure 822 - Drilling Idle Path-3 (The Secret Passage)

Figure 822 illustrates cleaning a small, short passageway using a # 53 drill bit. The path segment is very short, extending some 5/8" -- across the breadth of the stem, from Idle path-2 over to the Idle Needle cavity.

Figure 823 - Drilling of both Idle Orifices

Figure 823 illustrates drilling of both Primary Idle Orifice and Secondary Idle Orifice with two very small drill bits. Observe that the Primary accepts the smaller bit (# 60) while the secondary accepts the larger # 57 bit. DO NOT OVERSIZE THESE ORIFICES! These two open into Idle Path-1. It is the Primary Idle Orifice along with Idle Path-1, -2 & -3 that make up the continuous path for fuel-air mix to flow from the base of the Idle Needle to the engine. These along with air from (1) Idle Air (in) and (2) Added air from the secondary Idle Orifice make up the entire Idle System.

DLTX26 and DLTX46 Carburetor Overhaul
~~The Procedure, Part 2~~

20. Clearing LOAD and Raw Fuel Channels -- The four following pictures illustrate using drill bits in help clean and clear paths for LOAD (fuel) Air (in), raw fuel in, and the accelerating well.

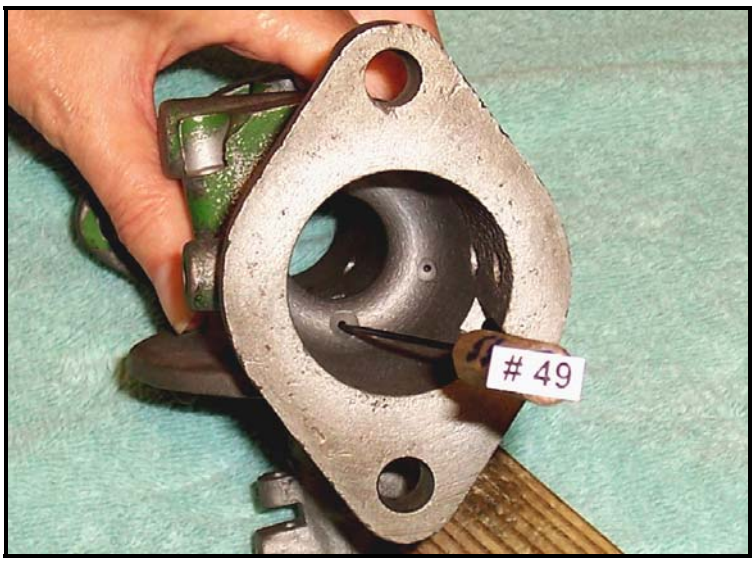


Figure 824 - Drilling LOAD (fuel) Air (in)

Figure 824 -- This opening must be open in order to maintain a certain surface pressure on fuel in the accelerating well, opens directly into the fuel nozzle cavity (accelerating well). Note that Nozzle is NOT INSTALLED when drilling. No. 53 drill bit may be used.

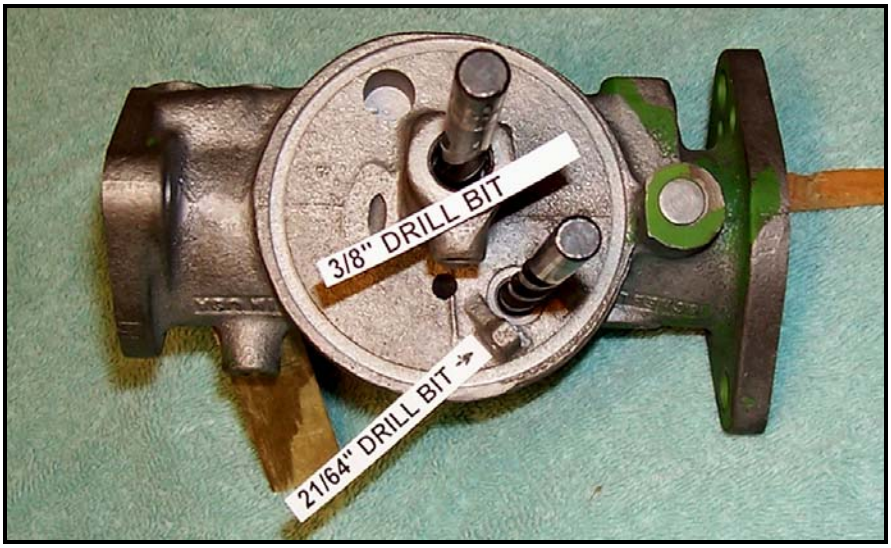


Figure 825 - Drilling Fuel Inlet and Accelerating Well

Figure 825 -- Here is a simple removal of iron oxide and other 'left-behind' contaminants which may restrict fuel flow in (21/64" bit), or the volume of the accelerating well (3/8" bit).

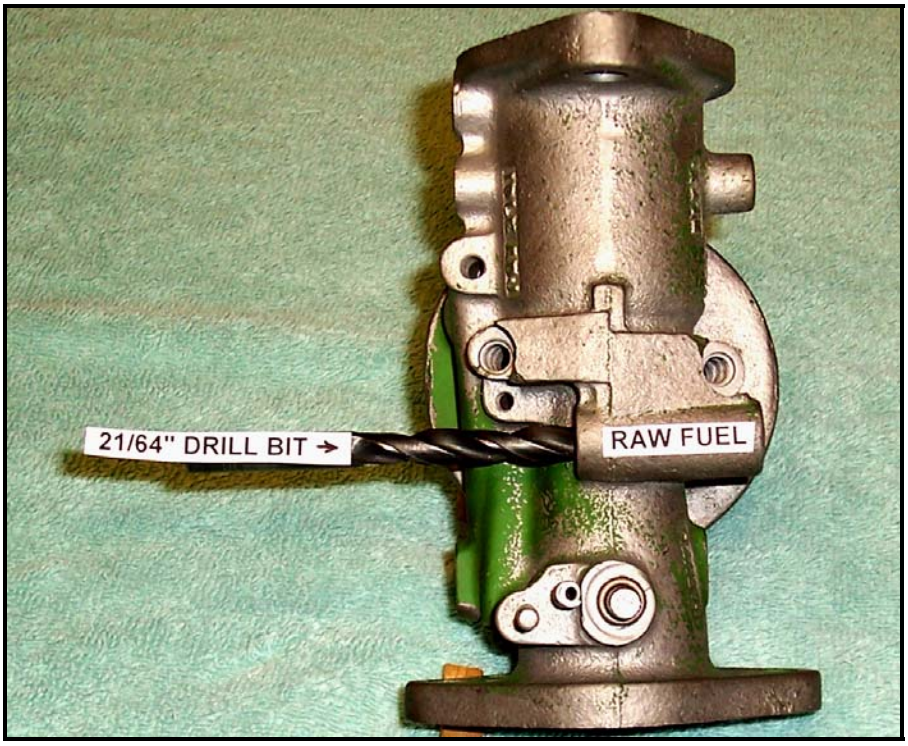


Figure 826 - Drilling Fuel Inlet-2

In Figure 826, we open the channel for fuel, drilling to the turn, of the socket that receives the fuel inlet fitting. **Remember** -- drive these bits by hand!

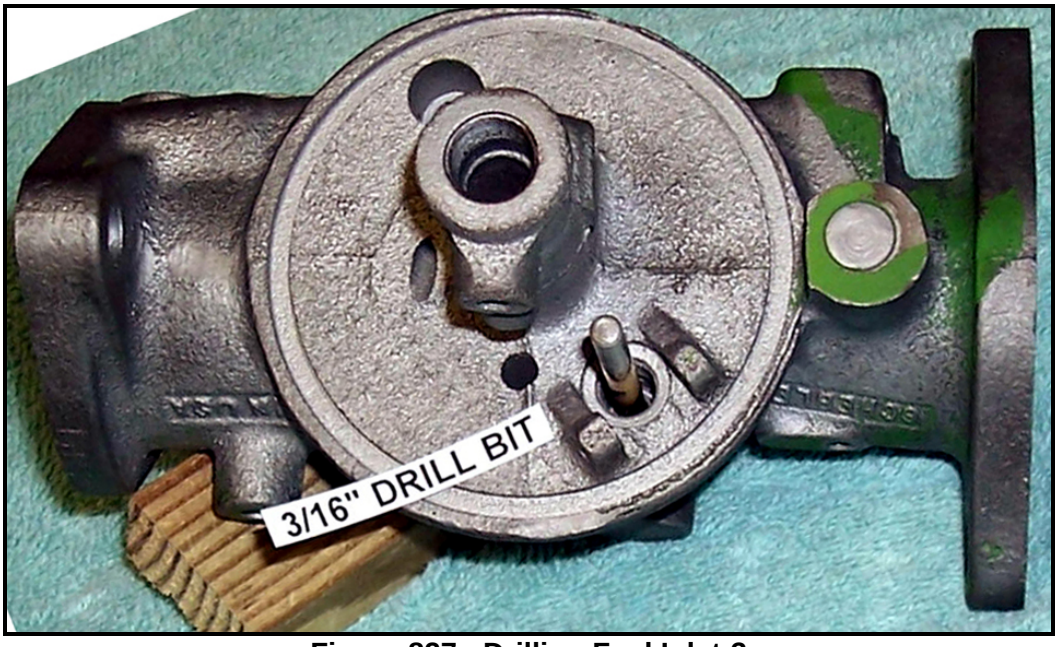


Figure 827 - Drilling Fuel Inlet-3

Here in Figure 827 is a drilling through to the turn of the fuel inlet path -- along with operations illustrated in Figures 825 and 826 to complete the fuel inflow path.

21. Clearing Bowl Vent and Economizer Paths -- The remaining three pictures illustrate using drill bits to clean and clear paths for the Bowl Vent, and its companion circuit - the Economizer Path.

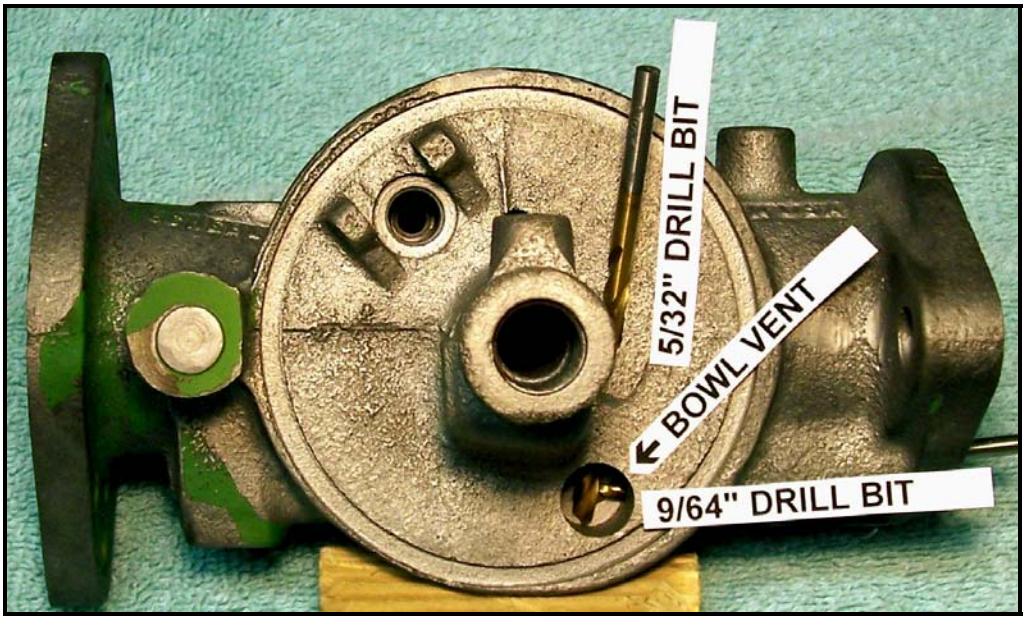


Figure 828 - Drill Bowl Vent

Figure 828 depicts the bowl vent cavity nearly opposite the needle valve fuel inlet. Refer back to Figure 814 for where the 9/64" drill bit comes in from, "Bowl Vent Air (in)."

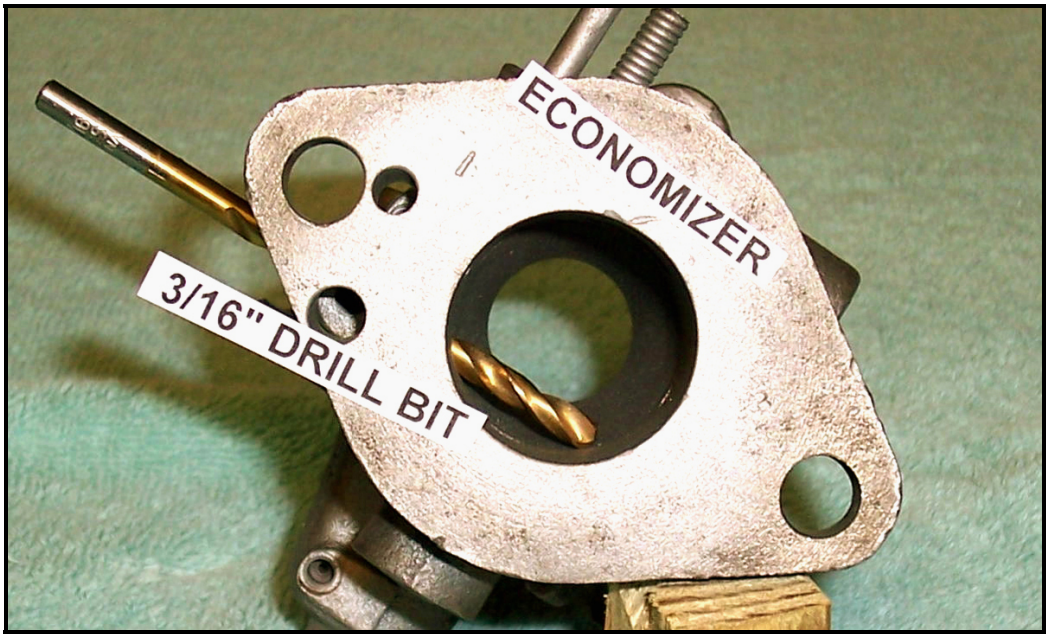


Figure 829 - Drilling Economizer Path

The 3/16" drill bit shown in Figure 829 ensures the economizer port is cleared. Refer back to Figure 816 for perspective on the location of this port in relation to the throttle valve.

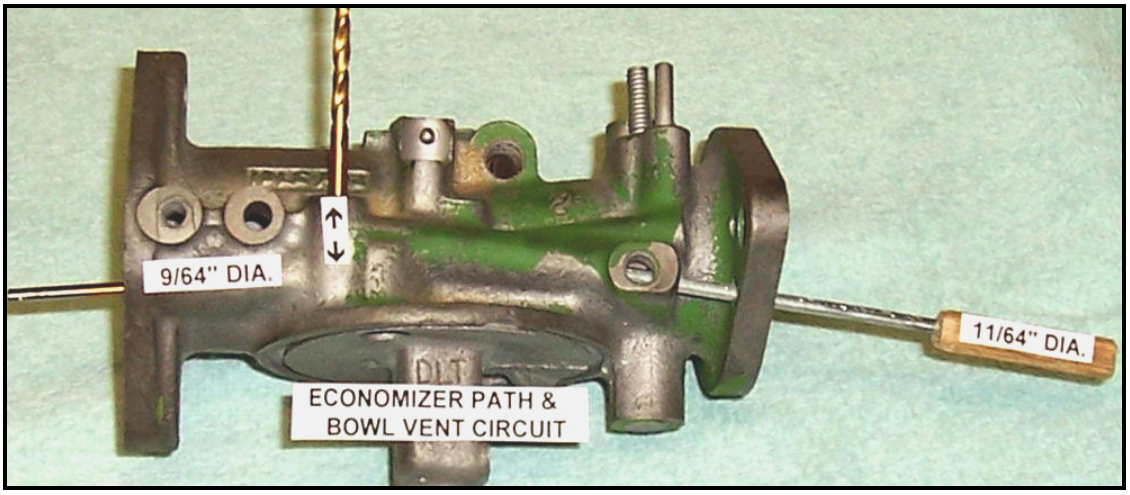


Figure 830 - Economizer Path and Bowl Vent Circuit

Figure 830 illustrates the interrelationship between the Bowl Vent Air (in) and the economizer path/circuit. This path must be open for efficient half-throttle/economizer operation.

22. Final Cleaning and lube -- Once all drill and clean operations are finished, thoroughly clean carburetor body with compressed air, inspect very carefully to ensure no foreign material remains in or near the now-cleared passageways. Then follow this cleaning with an application of aerosol lube with emphasis of getting lube into passageways -- to prevent rusting again while in storage. Once pressed back into use, the carburetor is again subject to its usual enemies!

Inspection and Repair - Criteria

23. Fuel Inlet Strainer -- Agitate fuel strainer screen in cleaning solvent and inspect for holes in screen or burred threads. Replace if damaged.

24. Float Valve and Seat -- Inspect tapered surface of float valve for wear, ridges, or burrs. The surest method to detect any irregularities in the float valve is to move it across your teeth! If you feel a click on your teeth, replace both the float valve and seat as a matched set.

Inspect valve seat for thread damage. If valve seat or float valve are damaged in any way, replace both parts -- again, as a matched set -- do not ever replace one or the other individually.

NOTE: When installing a new float valve with a chrome-plated seat, plating on the taper cannot be polished. A few hours of field service will automatically polish and seat the valve to its seat.

25. Float -- Inspect float for cracks or unsoldered joints. For a positive check for leaks, immerse the float in hot water. Appearance of bubbles will indicate leakage. Do not attempt to repair a damaged float. If it leaks, replace it. If the float is the old cork type, discard it and install a metal float.

Inspect float lever pivot pin. Replace pin if it is worn sufficiently to permit float movement from side to side of bowl, or if it is bent.

26. LOAD needle and IDLE needle -- Examine the taper on the ends of the load and idle needles. If a ring has been cut in the needle taper by turning the needle too tightly against the seat, replace the needle. Any variation that can be detected by the human eye is sufficient grounds for replacing the needle!

27. Fuel Bowl -- Examine fuel bowl for cracks or damaged seating surface. Inspect threaded holes for damaged threads. Repair or replace if damaged. Be sure all scale and rust have been removed.

28. Fuel Nozzle -- Inspect nozzle to be sure small holes are not plugged with carbon or dirt. Replace nozzle if it is damaged or if openings have been altered. A cleaned nozzle should have a shiny brass finish and all of the little holes should be open. Whatever you do, don't enlarge them hoping for increased power! It don't work out that way.

29. Carburetor Body -- Inspect body carefully for cracks and be sure the bowl seating surface is clean and in good condition. Make repairs as required to cracked or damaged areas. Leaking of air may be okay on the inlet air side of the venturi, but from the venturi on to the engine manifold, unintended passage of air will degrade performance. This includes loose throttle shaft bushings, cracks in carburetor body near the bushing seats, and casting breakaway in the bushing area (see Figure 831) resulting from (perhaps) a careless act (in the past) during bushing replacement. A tractor with this carburetor will not run! The throttle valve must close!

Figure 831. Casting breakout at Upper Throttle Bushing

This defect was repaired by Robert's Carb Repair for a total of $65.00 (2004). This fee included casting repair, reseating of the bushing, a new felt washer, new throttle disk, and freight for the carburetor back to me. Very reasonable indeed! So, do not bypass a needed repair like this one in attempt to save money. The grief this little break caused during engine test was testimony enough for me!

30. Brass Drill Plugs -- Finally, inspect all drill plugs for thread damage and renew as necessary. Highly recommended is to plan to install a new set of brass drill plugs; and install these along with all other brass parts, AFTER painting the carburetor body. I usually insert the old ones during the PAINT phase of carburetor overhaul to keep paint out of the tapped holes, then they are returned to my "grubby box".

Final Assembly and Test

Final Assembly and Testing is accomplished in four separate stages. They are: (1) Renewal (as needed) of throttle bushings and the stop spring, and needle friction balls and springs, and chasing of threads. (2) Applying JD Classic Green paint to normally painted parts, (3) Basic final assembly - ready for installation, and (4) Dynamic functional testing on a tractor engine.

31. Renewal:

Throttle Bushings -- Install throttle shaft bushings by pressing them into the carburetor body. An ordinary shop vise works well for this task. Be careful not to press bushing in too far, to a point where you have interference between bushing and throttle disk motion. If installing new bushing in both positions, install the lower bushing first -- and when installing lower bushing, use protective blocking so that vise jaws do not damage upper bushing area of carburetor body. With bushings installed, insert throttle shaft in carburetor body to test for binding. If binding is present, the bushings must be reamed to achieve smooth rotation. You need a non-binding fit.

Throttle Stop Spring -- if throttle lever stop spring was removed, install a new one using a hammer -- drive spring in until it bottoms in bore.

Needle Friction Balls & Springs -- Check to see if small friction balls are in place. If they have loosened, they undoubtedly would have come out when needles were removed. If so, reinstall springs and balls, and peen edges of holes slightly to hold balls in place. See Figure 832.

Figure 832 -- Needle Friction Ball

Chase Threaded, tapped holes -- Depending on threaded areas which need to be chased, find below a chart of specific taps you will need for each unique application. The Table of Taps needed for chasing threaded ways:

Brass Drill Plugs

Item # 4	1/4-28 Drill Plug (1 place)
Item # 5, 19	10-32 Drill Plug (5 places)
Item # 21	12-32 Drill Plug (1 place)

Other threaded regions *Exercise extreme care not to drive an NPT tap too deep into tapped hole because doing so will usually make the threaded hole TOO LARGE!*

Item # 3	Fuel Inlet (1/8 NPT or 3/8-27) ➔ *See NPT tap NOTE above*
Item # 22	Economizer plug (5/16-24)
Item # 24	Needle valve (1/8 NPT or 3/8-27) ➔ *See NPT tap NOTE above*
Item # 26	Fuel drain (1/8 NPT or 3/8-27) ➔ *See NPT tap NOTE above*
Item # 27	Bowl Nut (1/2-24)
Item 9, 10	Idle & Load needle (1/4-40)

32. Painting:

Creatively use masking tape and plugs to keep paint out of carburetor body and threaded holes. Paint all small piece parts, masking as required so as to keep paint off brass parts. **Do not paint any internal parts of the carburetor**. Do not forget to paint the 3/8 x 1" cap screw & its lock washer for lower hole on air (intake) end of carburetor. Allow paint sufficient time to cure before proceeding. I used John Deere Classic Green aerosol canned paint and it turned out just fine.

Figure 833 - Carburetor Body With Bowl - Masked, Plugged and Ready for Paint

33. Basic Final Assembly

a. Remove masking materials and clean carburetor body with compressed air.

b. **Choke and Throttle Assemblies** -- Install choke assembly, followed by the throttle shaft & disk assembly. Be sure breather in choke disk is at bottom when choke is in the fully closed position (Fig 834). Secure assembly to carburetor body with friction washer, spring, washer, and choke screw - tighten until shoulder of screw seats against carburetor body.

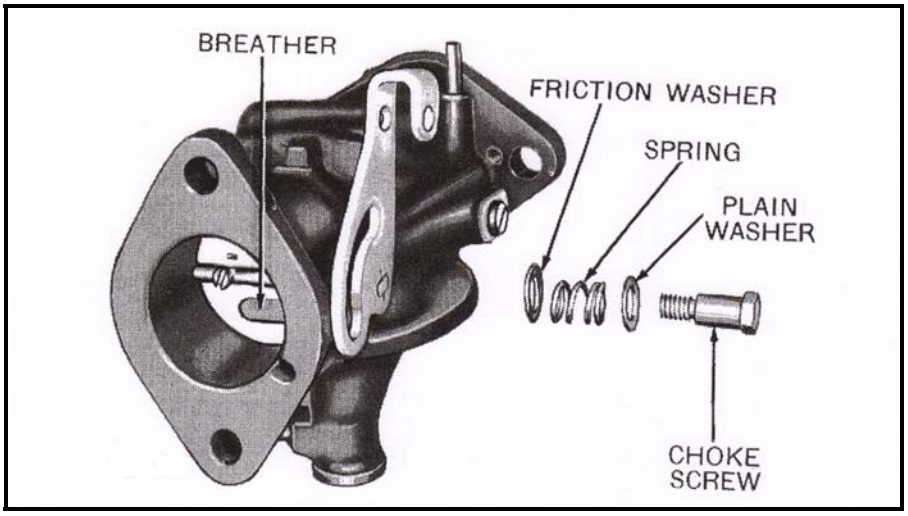


Figure 834 - Choke Assembly is being Installed.

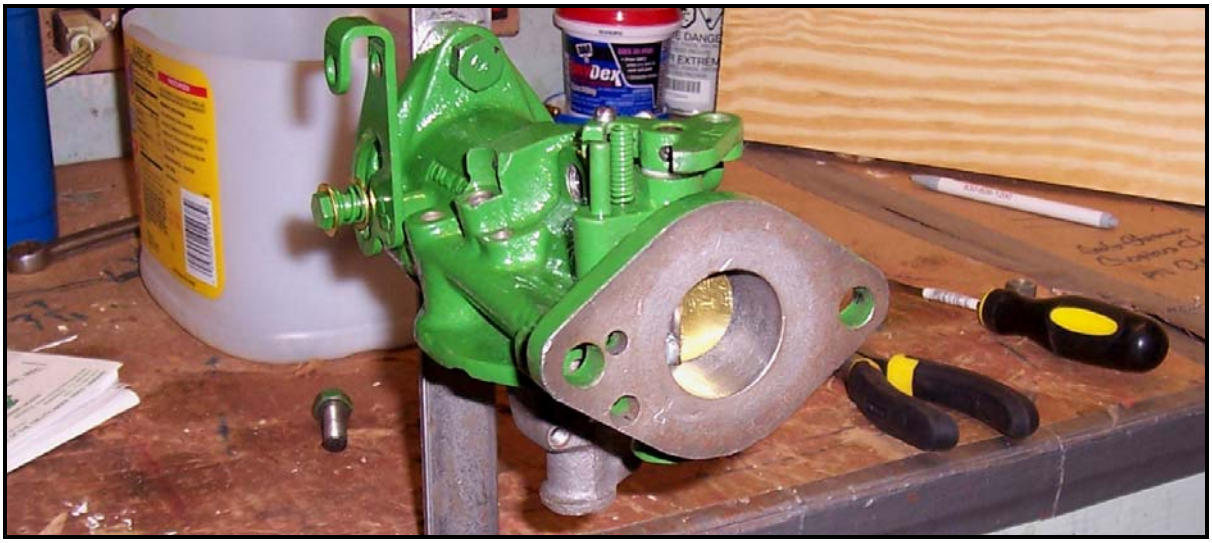


Figure 835 - Final Assembly Continued - Throttle Installed

c. **Install inside-carburetor-bowl series** -- fuel nozzle, two brass drill plugs on stem, float valve seat with gasket, float valve, float, nozzle spring; then carefully seat bowl gasket into casting. **NOTE**: When installing fuel nozzle, give no consideration to position of the holes in side of nozzle -- their position has no effect on carburetor performance.

Float Valve TIP -- Check the float valve for leakage by turning the carburetor upside down and sucking on the fuel inlet pipe. If the valve is not leaking the suction created will be sufficient to hold the tongue similar to the way it would be if place over the end of a coke bottle.

NOTE: Be sure to install 3/8 x 1" cap screw BEFORE attaching bowl to carburetor body. See Figure 836 below.

TIP -- For some simple no-leak insurance at the bowl nut, install a thin (1/64-inch thick) paper gasket, inside the bowl and fitted down over nozzle spring and bowl nut threads, between the bowl and carburetor stem.

d. **Install Bowl and Bowl Nut** -- NEW Bowl Nut is recommended! Do not over-tighten.

e. **Fuel Inlet Strainer** -- Shellac the inner cut of threads on the strainer assembly and install. Be careful that no shellac gets on the strainer screen. Tighten firmly, but do not over-tighten.

f. **Brass Drill Plugs** -- Install remaining brass drill plugs and fuel economizer plug; tighten snuggly, no need to bury them!

g. **LOAD and IDLE needles** -- The IDLE needle is designed with the longer taper and is the shortest. Set LOAD to one turn out, and IDLE to 1-1/4 turns out. DO NOT run needles down onto seat with excessive force or torque that may damage needle tapers.

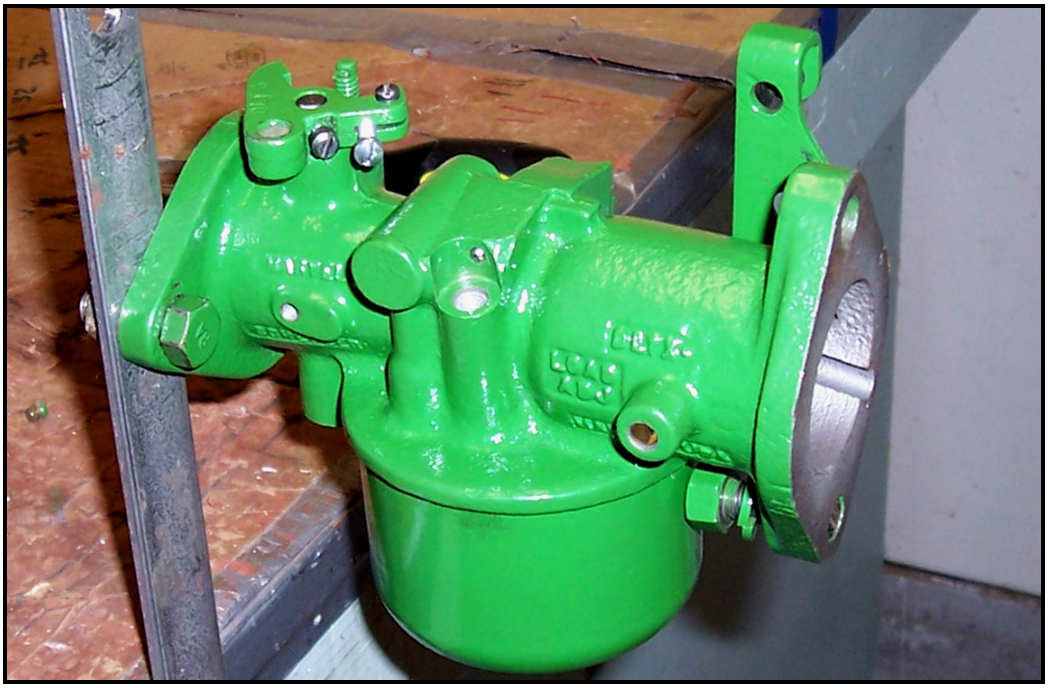


Figure 836 - Bowl Series Installed. Note the 3/8" Cap Screw Pre-installed

34. Dynamic Functional Testing

Install carburetor on known operative tractor (test) engine. Install the fuel-input line, air cleaner interface, and throttle rod.

Throttle Rod Adjustment -- Disconnect throttle rod from the carburetor, push speed control lever full forward, and hold carburetor throttle lever in wide open position. Given this set of conditions, throttle rod end should be one-half hole short of entering hole in carburetor throttle lever. If adjustment is needed, disconnect rear end of throttle rod from governor lever, loosen jam nut and turn throttle rod end until length of the rod is correct. Tighten jam nut and connect throttle rod.

Start engine, bring up to operating temperature and perform testing of both IDLE and LOAD pathways as outlined in paragraph # 35, and then perform trim-out settings to determine end-result settings are in "the zone" of acceptability as outlined in paragraph # 36.

Shut off fuel supply and allow engine to run out of fuel. Drain residual fuel from carburetor, disconnect fuel lines and remove carburetor from test engine. Allow all fuel to be drained from carburetor, and after allowing time for carburetor to completely dry, shoot a light lubricant like WD-40 into carburetor from each end as preservative until ultimate use. Tape over ends to keep foreign materials out, then store in suitable container.

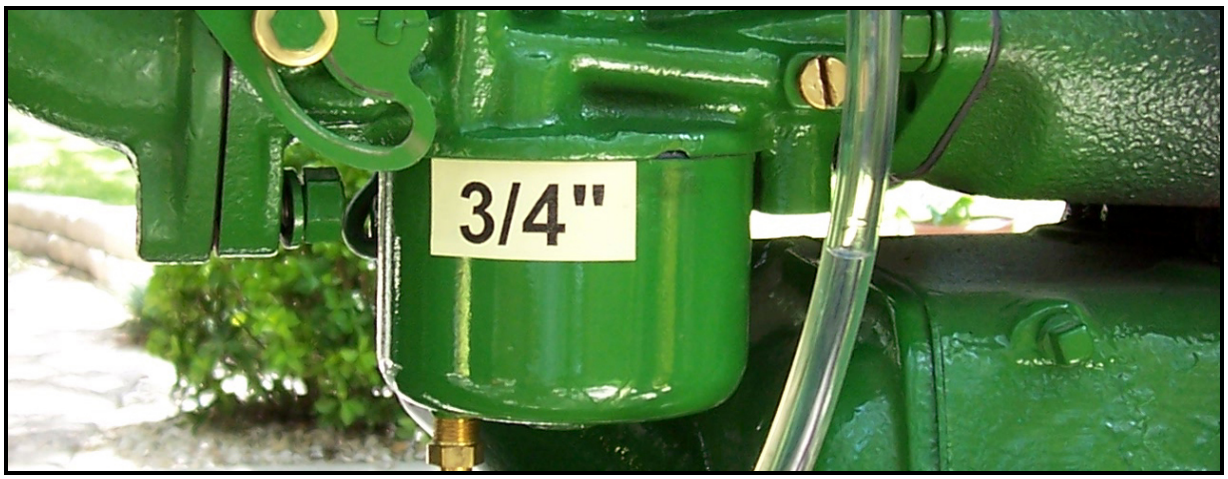


Figure 838 -- Float Level Test Kit Installed

Figure 838 illustrates float level testing should this event become needed. Install 1/4 hose barb in place of fuel drain cock, and connect transparent tubing as shown. Open fuel valve to check float setting -- see fuel at 3/4 inch below top of bowl. When finished, remove hose barb and hose and reinstall fuel drain cock. Use Teflon tape and do not over-tighten.

35. Testing -- LOAD and IDLE Pathways

A test is conducted to double-check your carburetor's IDLE and LOAD pathways by manipulating the IDLE and LOAD needles. Here is how it goes:

(1) BE AWARE: This test involves radical adjustment of both the LOAD and IDLE needles. Before starting the engine, observe the position of each needle lever, and count the number of turns OUT that each of the two needles is at so that you can put them back where they were before this test is run.

(2) With the tractor running at least at half-full engine speed, turn the LOAD needle all the way in. The engine will continue to run if the IDLE SYSTEM is open, and if it stops running, -- the idle system IS NOT open! Assuming this test is a pass, reset the LOAD needle where is was and go on to the test below. **Note**: This (IDLE) test may not be reliable for DLTX53 Carburetors.

(3) With the engine running at full-throttle (fast idle), turn the IDLE needle all the way in. The engine will continue to run provided the LOAD FUEL system is open, however, in this mode, engine operation will be a throttling pattern. As engine speed drops, the governor will open the throttle to draw LOAD FUEL because the idle path is closed. This pattern, however, indicates the LOAD FUEL channel is open and working as it should. If the engine stops running, the LOAD FUEL channel is blocked.

36. Adjusting the Carburetor -- If this carburetor is being installed for the first time on this tractor, preset idle needle to 1-1/4 turns out, and load needle to 1 turn out.

TIP: Before attempting to adjust carburetor, ensure ignition system is in top shape. Ignition points on your magneto should be clean and set to 0.015" opening/gap. Remove and clean spark plugs, setting gap at 0.030" before reinstalling. Ensure all connections are sound. Setting of your carburetor is meant to be a permanent event; one not needing to be changed unless there is a major change in weather temperature or you change fuels.

The carburetor mixes liquid fuel and air together to form a fuel vapor. The carburetor is provided with adjustments for smooth engine operation, fuel economy, and maximum power.

In making carburetor adjustments, the engine must be warmed up first. Then, with the speed control lever half way between slow and fast idle position, adjust the idle needle until the engine runs evenly. (Fast Idle equates to full speed.) In warm weather, this varies from 3/4 to 1-1/4 turns, and while this setting may vary on individual tractors, and once made, should not have to be changed.

For all-around maximum economy, apply a load (belt load preferred) to the engine; which will operate the carburetor throttle lever in approximately the ¾ open position. Adjust the load needle, turning it down until the engine loses power or backfires, then open one, two or three notches – whichever gives desired performance. In warm weather, this should leave load needle open approximately ¾ to 1 turn; this adjustment should give the best economy for all loads, and should not have to be changed unless cold weather causes a lean mixture.

If governor closes throttle entirely when load is released to cause uneven running, screw the throttle lever stop screw in against stop spring until tractor idles satisfactorily.

Caution: Carburetor should not be adjusted while tractor is moving. ++++

37. Throttle Disk Adjustment (FSB 189-S, March 1952) -- On John Deere Models "A" and "B" Tractors, wear on the throttle lever and upper throttle shaft bearing boss sometimes allows the throttle shaft assembly to drop, causing the throttle disk to bear on the carburetor bore. This condition causes erratic governor action, or "hunting."

Correction is easily made by removing the throttle disk and using a rat-tail file to remove a small amount of material from the lower side of each of the two holes in the disk (See Figure 37). This allows the disk to be moved slightly toward the throttle lever, providing clearance between disk and carburetor bore.

The use of washers to effect this clearance is not recommended, because of the difficulty in obtaining washers of varying thicknesses to provide for all possible degrees of adjustment.

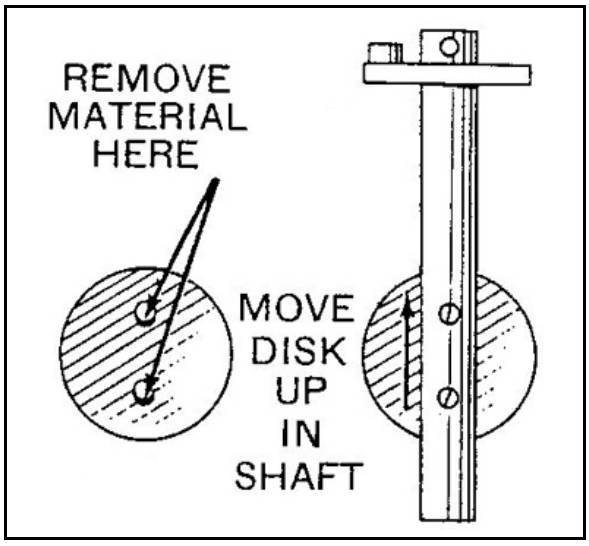


Figure 839. Throttle Disk Adjustment

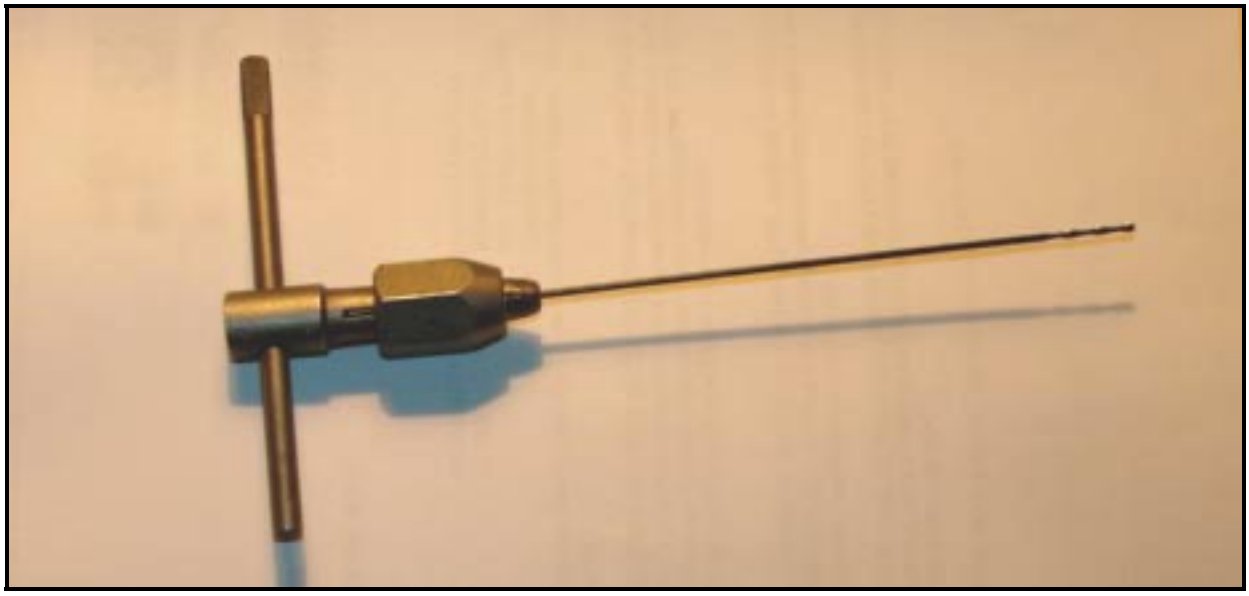
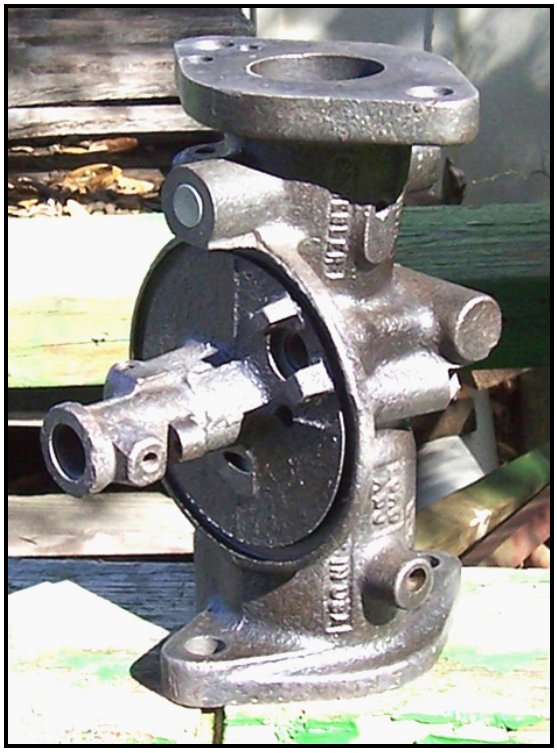


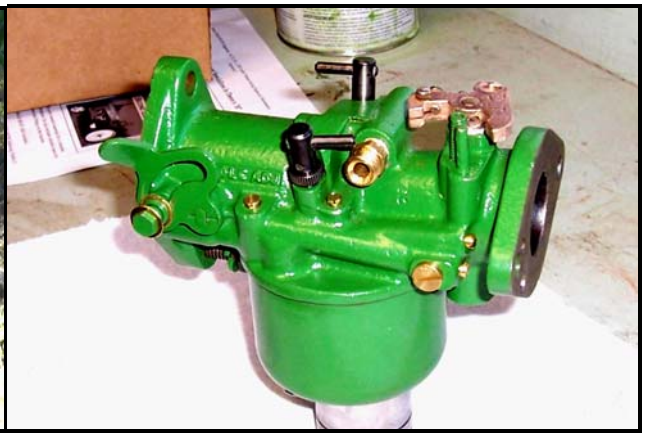
Figure 840. Small Tap Handle used with Aircraft Drill Bit

Figure 841 (A&B) Pin Vise and Double Pin Vise

Here & There



Before and After Painting
DLTX26



Paint and Painting

Chapter 9

The painting of a tractor surely is a major part of the restoring effort. You think about it all the time, from day one to the end! All of the cleaning and repairs, plus having some place to shoot paint make up a substantive part of the mental planning we do as we clean and repair! This is also an area where you can suffer major heartbreak because the evidence of a problem is always in plain sight for you and everyone to see. Green paint on electrical wires, fuel lines, fan belts, the axles, or even on the radiator sends a message that you don't want to send. Paint that isn't quite the right color, or isn't fading to the right color is another outcome you don't want. What is the best paint? Do I use synthetic enamel or some of the acrylics like that used on cars? Where should I buy my paint? What about additives to paint? What are their effects? How about primer paints? Does it matter about primer? Do I even need it? Who can answer my questions about paint? What about the aerosols?

Once was the day when people in paint sales knew the product lines of their competition as well as their own. They could talk intelligently about how their products would perform in relation to some of the competing products that you may already have used! Generally, such is no longer the case. It just could be that you are already in a corner, and need help getting out. Travel to a store selling Dupont paint for example and you will find a person well-versed on the entire Dupont line, but ask a question about a Dupont product in relation to the paint you already have applied, and you get either a blank stare, or "I really don't know." They then ask you some questions you can't answer. By then you realize this conversation may not get the job done! I had used aerosol primer paint from Ace Hardware to protect the pieces as I cleaned them up, one-by-one. Naturally, I wanted to hear the Dupont sales dude tell me I was okay, or that there was some specific act I had to do in order to make his product work. He just didn't know. When I called the Ace Hardware man, he told me I had no reason to worry; that the Ace paint was 'top of the line.' Was this really true?

Find Engineering Help -- It's Out There! -- This writing is not to make you a paint expert, but to help you understand that if you are going to experiment, you are on your own. Do some research beforehand. Those who sell paint may know their own products, but then again, they may not! When you do get in trouble, you probably should make contact with a paint engineer. I once was overwhelmed with a paint-curing problem while using paint I purchased from the Ford/New Holland dealer for a Ford 4000 tractor. The folks at the dealership didn't know what to tell me. After some research, I determined that Valspar Inc. manufactures the paint for Ford/New Holland. I made initial contact with the Valspar Customer Relations Department with my problem. Within two days, an engineer named Shawn Mahady phoned me with the solution. As it turns out, I needed to have added both Slow Reducer and Catalyst to make this paint cure in cooler weather and have a nice shine to it. Further, because of the alkalinity of the paint, only a few select product lines were to be considered here. Limco 1-2-3 by BASF proved the right one that day. Shawn gave me the ratios to be used for the weather conditions I faced, and I followed them. The job was a success! I have sought Shawn's counsel on at least one subsequent occasion. These people are professional paint troubleshooters, and eager to provide you with the help you need.

Aerosol Paint (Rattle Can) --- Something needs to be said about paint in aerosol cans. You probably won't be disappointed if you don't expect much. I have painted entire tractors using John Deere Green from Ace Hardware aerosol cans! As long as I wasn't looking for a deep shine, no sweat. As long as my tractor wasn't parked next to one painted with 'real' John Deere paint, okay! The tractor was clean, used on the farm, and at church functions like hayrides. It was a real hit! The paint stood up to farm work very well. If your expectations are low, any conveyance of those two fabulous colors of John Deere Green and Yellow will suffice. The restoring industry folks generally do not consider aerosol canned paint acceptable for finish-coating any major part of a tractor. And if it

is used as a finish coat, there should be clear division between where it is used and where gun-sprayed paints are used. Often a shade differential will show up.

I have, however, had good service from John Deere aerosol canned paint, but its durability is a direct function of cure time allowed -- minimum five days, 30 days better! Limited use of special kinds of paint becomes another issue. For example, I have successfully used Aerosol RUST-OLEUM™ Gloss Black on the grip section of a steering wheel with very good results. Perhaps the key there was the four to six weeks of cure time!

Primers -- For the hobbyist restorer, the most practical use of aerosol canned paint is as a primer coat because of the wide expanse of time over which the job is spread. Cleaning is done one piece at a time, and once cleaned and prepared for primer, the primer should be applied then, not days later. Quality etching primer is available. The old timers will say, "Buy the good stuff." Folks generally approve use of aerosols on the cast portions of your tractor, but not on the sheet metal, or tin as some call it.

TIP: One fellow told me that for years it was his practice to set the cans in hot water to warm up the paint. Then SHAKE, SHAKE, SHAKE! The warm paint goes on a lot smoother because the pigment mixes better and the warm propellant produces considerably more spray pressure, and breaks apart the spray pattern better than cold paint.

From the John Deere aerosol can of Buff Primer Sealer, we read, "This primer sealer is formulated as a rust inhibitive type primer with excellent adhesion and durability on properly prepared bare metal surfaces. Effective methods of cleaning metal are sanding, sandblasting, wire brushing, scraping or buffing." This product is hard to beat according to many who are using it; but again they also do not care for it on sheet metal. This product does contain some long-curing solvents, thus one should allow at least a week of cure time where temperatures are 75 degrees or higher for over half of the day. It's not the only "good stuff", but you now have a place to start!

OSPHO™ -- EXTEND™ -- RUST CONVERTER™ -- PH-OSPHO-RIC PLUS+ ™

No painting discussion would be complete without mention of OSPHO ™. Similar products on the market include Extend ™,Rust Converter™ and PH-OSPHO-RIC PLUS+™. Reading from the OSPHO™ product label we observe:

"OSPHO is a balance formula of phosphoric, dichromate, wetting agents and extenders. OSPHO is a primer, and not a paint. You merely remove loose paint and rust scale, dirt, oil, grease and other accumulation with a wire brush -- apply a coat of OSPHO as it comes from the container -- let it dry overnight, then apply the paint. When applied to rusted surfaces, OSPHO causes iron oxide (rust) to chemically change to iron phosphate -- an inert, hard substance that turns the metal black. Where rust is exceedingly heavy, two coats of OSPHO may be necessary to thoroughly penetrate and blacken the surface to be painted."

OSPHO ™ sounds like magic to one whose rust bucket tractor awaits his beckoning call! But there is no substitute for cleaning those metal surfaces by use of mechanized wire brushes, sanding, scraping, buffing, or even the ultimate -- sandblasting for select parts. My experience with these products has been very good, but nothing like the claims made in the OSPHO product label. It may be true. I've just not tried it! My practice is to take those 5 or 6 decades-old castings down to bare metal as best you can. Wire brush and sand, and 'for-sure' degrease and wipe with a tack cloth -- then apply OSPHO and allow to cure, the longer the cure the better up to a couple days. Once again, wire brush these surfaces and apply primer paint. What's the need for OSPHO -- if I am going to apply primer anyway? The answer is simple in that the OSPHO will 'convert' rust you were unable to reach and remove. It provides low cost insurance against that old rust bleeding through a new paint job in a few short years.

Fillers on Painted Metal --- You just finished a top coat on your tractor's frame rails. Now you realize that you should have used filler for the rust pits which are glaringly visible! To correct this and make the rails consistently smooth

throughout, does one have to sandblast again and start from scratch? Or can filler be applied, sanded, primed and painted? Single-part "putty" can be used over surface coats, to fill depressions the surfacer didn't cover, so long as you don't get it too thick. This is generally not recommended. One ought to avoid using a putty or filler over a topcoat. The best path is to take the pits to bare metal and use a two-part body filler; then follow with primer and paint.

Painting Over Un-Hardened Paint --- Ask a dozen folks on this subject and you will receive at least ten different answers! One thing is certain, and that is -- that the outcome IS NOT certain! Wrinkle and lift are the two main problems. As for paint types, we have alkyd and acrylic enamels, urethanes, and lacquers. The general rule is that it's unwise to apply one type over another. This is especially true if there isn't much of a wait between the applications. Application of hardened paint over uncatalyzed paint will work out so long as the base coat is fully cured (dry). Some painters will say a couple days cure time, others say the wait should be more like a week, or a month! A safe rule of thumb is to allow uncatalyzed paint 30 days cure time with daytime temperatures at least 75 degrees before recoating with paint containing hardener.

Sheet Metal -- Hardeners in Primer and Paint Coats

More often than not, successive coats of both primer and paint are applied to sheet metal parts during processing. There is usually very little time between applications. It is important when using paint additives like hardeners, to use hardener in primer coats as well. A principal problem from not using these additives in the primer coats is peeling away (lifting) of both existing and new coats. This problem may show later. For instance, a slight, glancing blow to the hardened finish coat will easily bring away a small void in your finish paint coat; the result of a small piece of the undercoat simply torn away! It can be very disappointing indeed when a beautifully painted tractor hood all of a sudden is beset with such a fault!

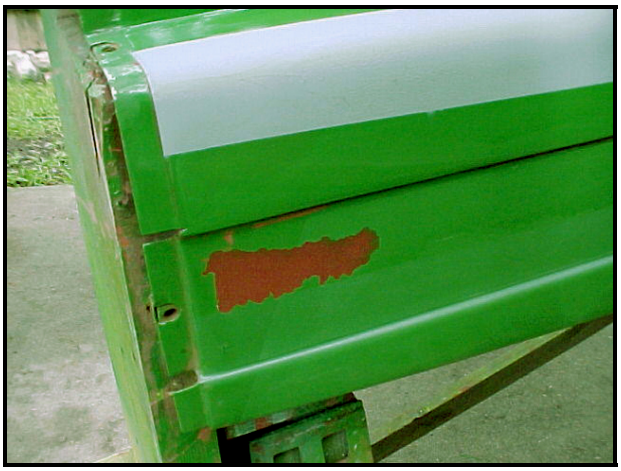


Figure 901. Paint lift occurred while removing blue masking tape, and was the result of applying hardened coats too soon over unhardened undercoats.

Figure 902. Paint wrinkle occurred having applied a coat of filler primer not compatible with prior paints, and again over coats with too little time to cure.

Technical Discussion --- If you paint using NO hardener -- and many do so successfully -- you have a paint film made of individual molecules that lay on the surface and by nature of solvent evaporation the paint (for lack of a better term) dries! If you add hardener, the molecules link together and become ONE continuous film and this crosslinking happens at such a small particle size that the film is also impermeable. Thus, a new solvent sprayed over it does not penetrate and cause problems. As for spraying over uncatalyzed paint, it has everything to do with the solvents and how aggressive they are. If they are aggressive and

you spray with a heavy first coat, you will have wet solvent laying on the surface which will start to penetrate and most likely cause problems. If you spray paint with a less aggressive solvent, or you spray the first coat not so wet, you will have less solvent to cause problems. Those who tend to spray wetter than others are likely to have more problems. This opens the debates about who has problems and who doesn't. Bottom line: if you don't spray too wet on the first coat and use good paint with quality solvents, you will probably be okay. The term "probably" is used loosely because alkyds are unstable, the most likely family of paints to result in problems.

I learned from folks qualified in painting techniques that catalyzed paint is best applied in three coats with an appropriate "flash time" between coats. Paint will either "dry", or it will "cure". Paint dries when the solvents in it evaporate and leave behind just the solid materials. Paint cures when the isocyanates in it cross-link with the molecules of resin and the solvents have evaporated. Solvents evaporate in two stages: a large surge of solvent evaporates immediately after application, followed by a slow time-released evaporation that takes about three months. When you wait for a coat of paint to dry before the next coat, you are waiting for the "surge" to release; the surge is also called a "flash" of solvents, thus the phrase, "letting the paint flash". At 70 degrees using quality paint with hardener, "flash time" is roughly 10 to 15 minutes.

Health Issues with Hardeners --- The final issue is health effects! Isocyanates are highly reactive chemicals typically found in the hardener of two-part paints and primers, and are a risk to health when they are released into the air during paint spraying. Breathing unreacted airborne isocyanates can cause coughing, chest tightness, fever, fatigue and sensitization. Once a person is sensitized, further exposure to even very small amounts of isocyanates will cause distressing asthma-like reactions. Skin contact with isocyanates may cause rashes, blistering, and reddening of the skin. Eye exposure to airborne isocyanates can cause eye irritation and temporary blurred vision, and direct contact with the eye may cause permanent damage to the cornea. When painting indoors, the operator should wear protective coveralls, protective headgear with a positive-pressure, air-supplied respirator. Charcoal respirators will not suffice. These items can be pricey, so for the "shade tree restorer", you are better off spraying paints with hardeners out in the open, right next to that shade tree if you insist on "toughing it out"! For further information, try the Internet looking for isocyanate paints or painting.

Painting Equipment and Tools -- Oil free compressors, spray guns, and moisture traps are the biggies insofar as painting and sand blasting equipment is concerned. Safety gear is extremely important, but not everyone considers respirators, face masks, supplied-air systems, eye and ear protection, paint suits, and gloves as equipment or tools.

Respirators -- Respirators or spray masks are the most important piece of safety gear. Professional grade respirators can be bought for under $60. Full face masks, or hoods, are a bit more expensive, but offer the benefit of eye protection along with the respirator. The best choices for respirators are the positive-pressure, supplied-air systems, or "hood" systems. See Figures 903 and 904. These systems provide fresh outside air. Prices for these systems, once the domain of professionals, have dropped to where they are affordable to hobbyists. Isocyanates can enter your body through your eyes, or any other mucous membrane. Positive-pressure supplied-air systems may be designed with their own air handler or with special-use filters so the shop compressor can be used. When using a stand-alone air handler, be sure it will draw air from a clean source. This might mean a very long set of lines, but if contaminated shop air is drawn, your unit will be supplying you with bad air!

Grade D Air, from NIOSH -- Hood and mask respirators are to have Grade D air supplied -- from either bottles or compressors. Hose length can be up to 300 feet, and delivery is to be at least 6 cfm for hoods and helmets, or 4 cfm for masks. The five criteria for Grade D air are (1) oxygen content is 21.5% +/- 2%, (2) hydrocarbons (oil mist) less than 5 mg/M^3, (3) carbon-dioxide content less

than 1000 ppm, (4) carbon-monoxide less than 10 ppm, and (5) there is to be no pronounced odor.

Equipment works only if used -- Respirators are effective only if you consistently wear them. Too many painters own respirators and don't use them. The mask should fit snugly to your face. Good respirators have adjusting straps and over-the-head networks to keep the mask in position. The filter cartridges in respirators are replaceable, inexpensive and should be changed out per manufacturer's instructions. Their effectiveness is dependent on the amount of paint fumes in air already filtered.

Figure 903. HobbyAir positive-pressure, supplied air system

Figure 904. Full mask or hood

Catalyzed Coatings -- The more components the paint has, the more likely (it is) to be toxic. Products that use catalysts (i.e., hardeners) can be very nasty. The chemicals are essentially making a plasticized product. If the paint dries to a rock-hard finish on your tractor, it can do the same thing in your body. When using catalyzed paints and after-coatings, your hands, face, eyes, and all skin surfaces need to be protected. You can buy single-use disposable paint overalls, or you can spend more and buy washable ones. Protective gloves are a good idea anytime you handle paint products, catalyzed or not, as are head socks that protect your head and hair. Hand creams that dry to a protective coating make cleanup much easier.

Moisture in Compressed Air Lines -- The air your compressor takes in contains moisture, and the compressed air doesn't release its moisture until it cools, this occurring more toward the end of the line. So when you use an in-line water trap, put it out at the end of the run for moisture-sensitive processes such as painting or sand blasting.

Dupont Paint/Automotive Paint Saga -- Another of my mistaken perceptions was to use "really great" paint -- the acrylic enamel type paint as is used on cars. Cars really shine, don't they? Hold that thought. I didn't know beans about clear coat technology other than auto makers had plenty of trouble with it! So I wasn't interested even in learning. But the shiny car finish was in my mind. Well, thought I, this tractor will shine too because I am headed to the automotive paint store. Surely, they can mix some John Deere Green, and some John Deere Yellow for me! It should be superior I thought -- sure costs enough! I paid double what I would have paid at the John Deere dealer, and I consider JD dealerships pricey to begin with! At any rate, I was on a roll. Friendly was the man who sold the Dupont products to me. He made sure I had everything: the paint, reducer, activator, lacquer thinner for cleanup, half-mask respirator, strainers, mixing bucket and paddles. From this store visit, I can tell you, he knows his trade and his products! So I departed, minus a considerable amount of my limited "hobby" dollars, now more anxious than ever to get to a point when I could shoot some of that new Dupont paint. The big day came! The result was fabulous and beautiful. The paint cured quickly just like I was told it would (I liked that), and the painted areas had that "wet look" that I so desperately wanted to see! That day, I was sold on Dupont paint products, and on the Dupont dealership.

The Shade of the Fade -- As time passed, I chatted with others in "the community" of restoring old farm tractors, and the horror stories came out. Yes, I had heard them before. I was spending more money on this tractor than on tractors of the past. My objective was different. This tractor will be my masterpiece! This tractor was destined to be a brand new 1942 John Deere Model "H" meeting all (or most) of the performance criteria it did the day it first left the factory. The first discouraging remarks made me reach out to experts that I know and respect. They told me I would regret using the Dupont paint. The secret, they shared with me, is the change in color of the green paint over time. I coined the phrase *"the shade of the fade"* to describe this happening. It could be that my "Dupont" John Deere would look like a million bucks next to other restored John Deeres the first year at the County Fair. But what about the next year? Would it look like an "orphan"? So I regrouped. Why pay $27 a quart and then take a chance that my Little Johnny would become an orphan?

JD Dealer as a Paint Source -- The basic answer, my associates all told me, is to buy my tractor paint from the local John Deere Ag Dealer; and for the older restorations, buy John Deere Classic Green. The John Deere Yellow for farm tractors hasn't changed. Seek Ag Yellow for the H, not Industrial Yellow! The same would be true, I suppose, if you were restoring a Farmall, Ford, or a Case tractor. Go to the dealers who now support these tractors with other parts. Notice, I used the word 'parts.' That is because when you go to that dealer and begin to ask all your paint questions of the sales attendant, you will find they know even less about paint; the reason is that the paint is simply yet another "part" to them. It has a part number, and a corresponding price! Well, I did go to the John Deere Ag Dealer to purchase paint, and paid much less than I would have for the Dupont solution. Then I started to listen to those in "the community" about how to mix, and how to apply John Deere Paints. John Deere selling paint for its tractors, I believe, leads more restorers to use John Deere paint than those using any other single brand. And there may indeed be more to this perceived preference than which is the best paint to use!

Synthetic Enamel -- Keep in mind that if you want to hire a professional painter to shoot any part of your tractor, and it is your intention to use JD Dealer supplied paint, be sure your painter is willing to shoot synthetic enamel (SE) before you go buy the paint. A fellow that I had lined up backed out when learned that I wanted him to shoot SE. He claimed he knew how to deal with acrylic enamel and lacquer painting problems, but didn't have a clue about SE! So -- work and plan ahead of your paint procurement. Talk to those you know who have been there and done that! I found one such person who called himself a "custom painter." Motorcycle parts and helmets are among the things he paints for cyclists. This was a "side job" for him. Law enforcement officers may be a useful source of how to find such experts.

That Deep Shine, That "Wet Look" --- As you can imagine, I was super excited with the nice green and the deep wet look I had with the Dupont coats. I was overcome with trepidation as I was about to make the switch. I learned up front that the John Deere paint was a SE, not the acrylic enamel I had come to admire in the Dupont paint! SE, by character, cures slower and generally does not have the depth (wet look) I wanted. Back to that again! This time, I knew who to call on -- a special friend. He opened up right away, and said, "Oh yea, there's this gloss additive and hardener the painter adds to get around the long cure time and it also gives you that wet look, the deep shine." I burst into a thousand questions at this comment. Eureka! I had found it! This is the product I need. It has been used successfully with John Deere paint and gives the desired result. The product's short name was "Hi Glo." It's real name is "S/E High Solids Hardener" from the Sherwin-Williams Automotive Finishes Corporation. Its part number of W1016. It costs in the neighborhood of $36 per pint, and is a commonly carried item by NAPA Auto Parts Stores. Whew! I was excited!

But in a world of things new and improved, a different product name and formula number was now recommended. It's SYNTHOL™ 8010, also sold by NAPA, carrying the Martin Senour Paints logo; at $36 per pint.

Martin Senour/Sherwin Williams (FH601) -- As time passed, Synthol 8010 phased out and is replaced by a Martin Senour product sold under the **CrossFIRE** label with a product number **15118** -- used with synthetic enamel (S/E) paint. And by this writing, the **15118** product is superseded by **FH601** (in pints), priced in the $25 per pint range; may be sold under ACME label. And so, if you choose John Deere S/E paint, also buy your paint reducer (thinner) from Deere and Martin Senour FH601 will be a winning combination. By this writing, your Deere dealer should also have a catalyst suitable for use with Deere S/E paints. As for ratio's of paint-reducer-hardener, ask around, seek a consensus, start with 8:2:1 and experiment some.

The Restoration Plan, a Paint Perspective

Before you start teardown, have a plan of action. Have a mini-parts cleaner for your nuts, bolts and washers plus other small items ready. Be prepared to control where oil and grease end up! Have space to store removed items, and your tools clean and ready. Clean up area and tools at the end of each day. Basic stuff!

The end objective is to have a tractor with the wear and tear removed -- one that looks like a "million bucks" when you're finished! Paint planning needs to be an integral part of all the process steps from start to finish. Painting is always on my mind. I even made checklists with the piece parts listed to track them through the processes.

The basic process for parts and subassemblies is: (1) disassembly or removal from the tractor, (2) degrease, (3) prepare for prime paint, (4) shoot primer, and (5) shoot a first coat of either green or yellow. During each of these five steps: (a) remain the super detective, looking for evidence of wear and tear, recording anomalies; deciding from among remedies available to you, and (b) decide when, in the process, to make repairs and restorations needed. Believe me. I've been between steps 4 and 5 above before I realized a part was not serviceable. For example, finding a freeze crack in the lower water pipe! Ideally, you want to find the defects during steps 1 and 2.

As you might imagine, for any given piece or subassembly, there is usually very little time between steps 3 and 4 above. If possible, try to accomplish these two steps on the same day. A first coat of each part's final color should be applied prior to being installed back on the tractor. Assuming you choose quality primer paints, you shouldn't have any compatibility problems with JD Paints. Passage of time is the key.

Keep paint off of gasketed surfaces and splined shafts (crankshaft and axles) and out of threaded holes. Be sure to have a good supply of blue masking tape in stock. It comes in handy and saves much sweat. If you err, there is always carburetor cleaner and ordinary paint remover. With carburetor cleaner, spray some onto a paper towel, and then swab the area you want to clean paint from. It's super powerful stuff, and must be used with caution.

Factory painting -- Movies taken of John Deere factory operations during the JD "H" production era show that tractors were completely assembled (with temporary skeleton wheels), then run-in and tested on belt-drive dynometers for power level and fuel economy before being painted green. Subsequently, pre-painted (yellow) wheels were mounted as one of the last assembly activities. Some items were masked such as gauge lenses, light lenses and rear wheel axles, but things like fuel lines, carburetors, water hoses, etc., were not masked, and were painted.

Hidden areas such as underside of the hood or under the platform were left unpainted. After all, these tractors were built for work, not appearance. In fact, that movie showed a touch-up painter slopping paint with a brush onto tractors. So much for factory paint quality!

Doesn't this process sound a lot like a "Spruce up" paint job? So if you are doing a spruce up of this or another tractor, feel free to apply a "factory paint" job! Just don't paint rear axles or splines.

Having outlined the crude factory paint jobs, one must point out that John Deere did occasionally make "**show**" tractors for expositions, shows, and fairs. These tractors were carefully detailed. Most restorers lean in this direction.

Expo Quality (show) Paint Plan -- Here are some hints. Items not painted include the radiator core, wheel axles, power shaft, ignition parts, brass carburetor parts, hoses, grip part of the steering wheel, temp and oil pressure gauge faces, light lenses, electrical harnesses, generator, cut-out relay, fuel lines and switching valves, and the sediment bowl assembly for openers. Applying Muffler Black (JD P/N TY25657) to the manifold, exhaust pipe and muffler is a nice touch too! Identifying items not to be painted early in the game will allow you to achieve better quality in appearance. Make a plan. Draw it out as a flow chart. You will need it early on as in the radiator, carburetor and steering wheel.

I often ponder the process of "final" painting all the pieces, and THEN put the tractor together in a clean room setting! The belt pulley, its cover and the flywheel can cause a lot of grief during final paint. It works best to final-paint these items BEFORE installation, and mask them off when shooting the main tractor.

The following items are not installed on the tractor at its paint station: (1) Magneto and ignition wires, (2) Carburetor and H139R air inlet elbow w/hose, (3) Seat, (4) Fuel tanks, lines, and tank brackets, (5) AH606R Pulley brake assembly (pull H363R pin), (6) Spark plug covers, (7) Sheet metal pieces (see below), (8) Steering wheel, worm shaft and nut, (9) AH937R Breather cover, (10) AH1030R Swinging drawbar (optional), (11) Exhaust pipe and muffler, (12) Clutch pulley cover, and (13) Wheels.

The following items are installed on the tractor, but masked off: (1) Spark plugs, (2) Radiator core rear side (closed shutter covers front side of core), (3) Radiator hoses, (4) H723R leather seal of the shifter quadrant (pack with tissue), (5) Air breather port of AH911R tappet cover, (6) Governor's magneto flange in part (center part only), (7) Left and right brake adjust screws, (8) Manifold, (9) Flywheel, (10) Clutch Pulley, and (11) all axles. Recommended items to be painted off-tractor include: (1) Carburetor, (2) H139R carburetor air inlet pipe, (3) Seat, (4) fuel tank assembly, (5) Fuel tank brackets, rear bracket w/wire loom, (6) AH606R pulley brake (mask off lining), (7) Spark plug covers, (8) Sheet metal parts, (9) Steering wheel, 10) Steering worm shaft w/nut, (11) AH937R Breather cover, (12) AH 508R, AH675R, AH1030R Swinging Drawbar, (13) Clutch pulley and pulley cover, (14) Flywheel, (15) Shutter knob, (16) Control rods for shutter and for throttle, and (17) all corresponding mounting bolts, nuts and screws.

When shooting sheet metal parts: Items not installed are: (1) Instruments, (2) Fuel tanks, lines and brackets, and (3) Shutter controls - knob and rods. A little discretion here -- the rims of gauges were painted green at Waterloo. If you want originality, paint gauge rims green. Either mount the gauges, mask off the lenses, and then shoot the instrument panel, or apply green to the rims beforehand.

Decals --- Decals are another element of planning to consider at this stage. Establish a source and choose a type. Then add the application of decals into your Final Paint and Integration Plan. Assuming hardener was used, painted surfaces should be at least one week old before installing decals, at which time final assembly can begin. If hardener was not used, wait 30 days to apply decals. As for your choice in decals, the die-cut vinyl type is highly recommended. This author shopped at Jorde's Decals in Rochester, Minnesota, and was superbly impressed with the result. Another source may be K&K Antique tractors. The time span needed varies with decal type. You can apply vinyl decals much sooner (in your planning) after the final paint shot because this is a "breathing decal". Extended decal discussion is in Chapter 2.

Parts Painted Black -- Light assemblies, generators, and cutout units (or voltage regulators) are painted gloss black. Starter motors generally ended up painted green as with most top-mounted JD tractor starters.

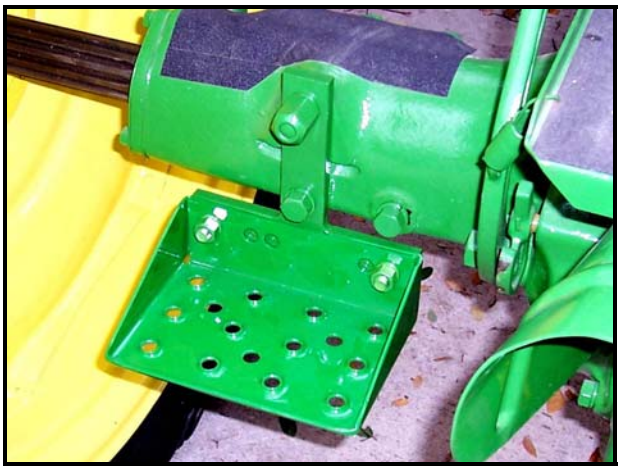


Fig 905. JD R27883 Safety-Step with centerline bracket mounted to left axle housing

Figure 906. JD R27883 Safety Step with offset bracket mounted to right axle housing

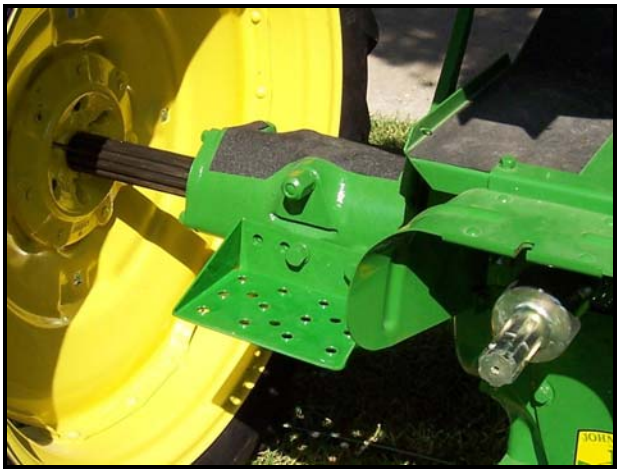


Figure 907. Modified R27883 Safety Step Mounted directly onto left axle housing

Classy Additions -- Here are three things you can add to your tractor to cut down on scratches to that new paint job, and increase utility at the same time. Getting on and off the tractor is basically a climbing action. Usually, you step first on the drawbar and then on the axle to make your way onto the platform and into the seat. A safety step may just be the answer. The other two items to consider are non-skid appliqué on the platform and an over-running coupler.

Safety Steps -- The steps shown in figures 905, 906 and 907 mounted to the left (or right) axle housing. Those with bracket are suitable for almost any two cylinder row crop tractor. The basic R27883 step fits most of the New Generation One JD tractors. Learn more by going to **www.jdhpubs.com**, and selecting **Tractor Safety Step**.

Nonskid -- The nonskid application was purchased at Home Depot and was 4 inches wide. It is adhesive-backed, therefore you must be sure you have it right where you want it before laying it down on the platform. A 4 inch strip was cut in half and then laid in along side a 4 inch strip to obtain the 6 inch wide application as shown here. Of the piece split in two, orient the 'cut side' away from the 4 inch strip already laid. This way minor irregularity in your cut will not be accented! See figure 908.

Figure 908. Black nonskid applied to the standing area of the platform

Over-Running Coupler -- The over-running coupler in Figure 909 is smart-looking and quite practical too. You have over-running protection and a full-sized power shaft all in one! These couplers come in variations to accommodate all sized power shafts. One way to shop: go to Google, and enter "Over-running Coupler". Also, check in with your tractor parts supplier. See more on over-running couplers in chapter 6 under "Frequently Asked Questions".

Figure 909. Over-running Coupler

Informative Letters on Paint Issues -- The following communication exchanges tell us more than hours of theory could in that this process isn't all science, but rather much a result of experience in painting. Perhaps the best advice one could give is to find a qualified painter and spend some 'practical time' with him (or her) to learn what is important and what isn't! Experience is far more valuable than theory!

==========oooooooooooo==========

Dear Charles; 11/28/03

If you can find out, I would like to learn from your painter what mixing ratios he found most successful when using John Deere Classic Green, John Deere Reducer, and the S/E High Solids Hardener (W1016) Hi-Glo from Sherwin-Williams Automotive Finishes, Inc. The local NAPA store here carries this hardener at a current price of $36/pint.

NAPA is suggesting 8:4:1 which I consider a little high for the reducer -- thinking 8:2:1 more in line; maybe even 8:3:1! See (if you can) what he thinks. Or, if you already know, please let me hear your words on the subject. Thanks.
Sincerely, Pat

==========

Hi Pat; 11/30/03

My painter doesn't have a clue to your questions!

He shoots the thinner to the paint, and stirs it thoroughly with a paint paddle, and looks at it dripping off the paddle. He then paints the tractor twice. After it gets tacky he mixes paint and thinner and gloss additive together and gives it another coat. He uses almost a can in two spray paint pots to cover the entire tractor and then lets it dry in a dust free state to give it that wet look.

I know this isn't much help but we don't use much ratio's in Missouri. We usually throw away the directions first as they are for Lab conditions.
Charles

==========

To: <autocontact@sherwin.com> 12/1/2003
Subject: Hardeners for Synthetic Enamel

I think I need an engineering answer, please. I am restoring a 1942 Model "H" John Deere Farm Tractor & want a nice shiny paint job, that 'wet look,' when I finish.

I have been advised (by old-timers) that your product called "Hi-Glo," Catalog # W1016, also known as S/E High Solids Hardener; is known to work extremely well with John Deere Classic Green, a synthetic enamel obtained through John Deere, & especially crafted for vintage John Deere tractors. My local NAPA dealer carries Martin-Senour "Synthol 8010," claiming it to be the same as the W1016 Hi-Glo described above.

One fear I have is that the 8010 hardener might not bring me the wet look I am seeking. Is Synthol 8010 indeed equivalent to Hi-Glo W1016? Will Synthol 8010 actually give me a higher gloss than Hi-Glo 1016? And is Synthol 8010 it compatible with John Deere's Classic Green paint?

I posed this same questions to Martin-Senour, and received call from Customer Service Department concerning the Synthol 8010 versus Hi-Glo 1016. So far as they know, the 8010 product will give a higher gloss than W1016, and considered the better product!

The rub in the conversation was that Martin-Senour cannot assure me their product will work well with a competitor's paint. (What's new?). Perhaps I will need to go ask John Deere's paint folks. But the good news is, they say, if the 8010 is not compatible with the JD color, it will show up right away.
Sincerely, Pat B.
==========
From: Rose A. Gasper/CLE/Sherwin-Williams@SWCBD [ragasper@sherwin.com]
Subj: Hardeners for Synthetic Enamel

The 8010 would be a higher gloss than W1016. It is a synthetic enamel hardener. We have had many customers use this with JD synthetic enamel paint with no problem. But is also true, that we cannot guarantee the mixing of paint systems.

Thank you, Rose
==========
TO: S/WCustomer Service (the website)
04/12/2004
The Question/Comment is:

Paints used (in general) are synthetic enamels. With the understanding that to paint is a three step operation of (1) light coat, (2) medium-wet coat, and (3) heavy-very wet coat with appropriate "flash" time between coats, I ask the following questions -- "Using synthol 8010 additive, will I end up with a nice hi-gloss by using the additive only in the third step, or must it be used in all three steps? And if either way will yield the same hi gloss, is there some advantage other than savings to use the additive only in the third coat? Conversely, is there any advantage (other than quick curing) to using the additive in all three coats? Thanks, Pat B.
==========
From: ragasper@sherwin.com 04-13-2004
Hi Pat;

If you are going to use hardener, it must be used in all coats as you cannot put catalyzed color over uncatalyzed color, it will cause a lift.

You are much better off using a hardener, it gives you more durability, a higher gloss, and if you make a mistake and need to recoat over the paint you can do so after 24 hours at 75 degrees.

The 2-3 coats (whatever you need to get coverage, everyone sprays different) should all be medium coats, with proper flash time in between.

Thank you,
Rose Gasper/CLE/Sherwin-Williams
- -

"Under HIS Wings"
(Real Life)

After a forest fire (Late 90's) in Yellowstone National Park, forest rangers began their trek up a mountain to assess the inferno's damage. One ranger found a bird literally petrified in ashes, perched statuesquely on the ground at the base of a tree. Somewhat sickened by the eerie sight, he knocked over the bird with a stick.

When he struck it, three tiny chicks scurried from under their dead mother's wings. The loving mother, keenly aware of impending disaster, had carried her offspring to the base of the tree; and had gathered them under her wings, instinctively knowing that the toxic smoke would rise. She could have flown to safety but had refused to abandon her babies. When the blaze had arrived and the heat had scorched her small body, the mother had remained steadfast.

Because she had been willing to die, those under the cover of her wings would live..."He will cover you with his feathers, and under his wings you will find refuge;..." (Psalm 91:4)

Being loved this much should make a difference in your life. Remember the one who loves you and then, be different because of it. ++++

Here & There

Sand Blasting rear wheels (left), and Finished D 65 pedal tractor (right)

Painting those raised letters; Masking (left), and the end result (right)

Full tractor masked off for final paint (left), and the end result (right)

Appendix 1, page 1

(OMR2011 Operator Manual Deficiencies, Ref DIR 276, dated June 1943)

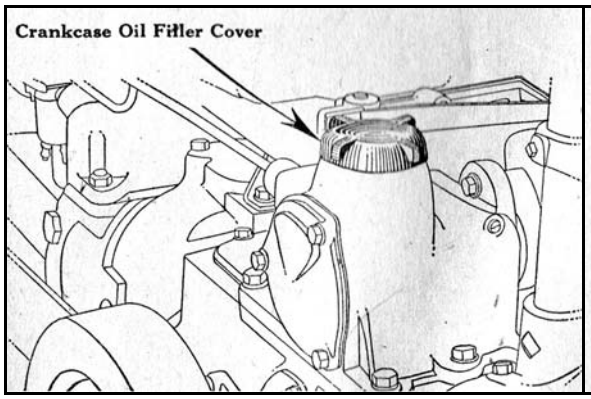


Fig. 1-1. Crankcase Oil Filler Cap

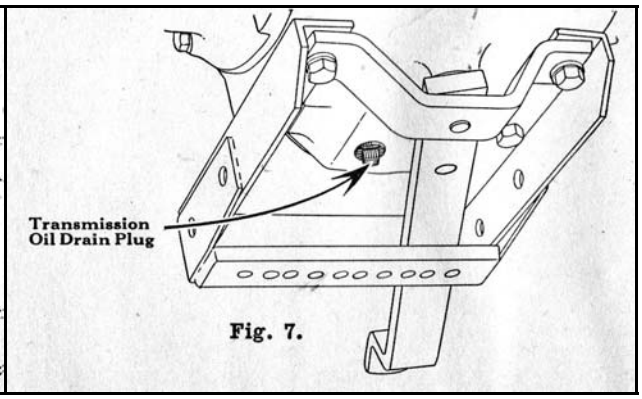


Fig. 1-2. Transmission Oil Drain Plug

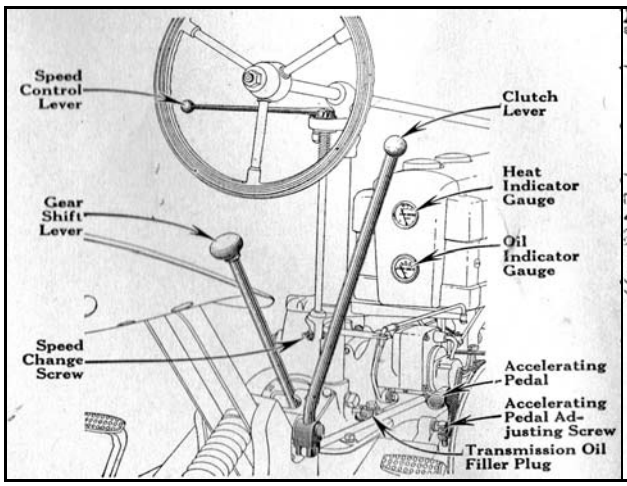


Fig. 1-3. Transmission Filler Plug

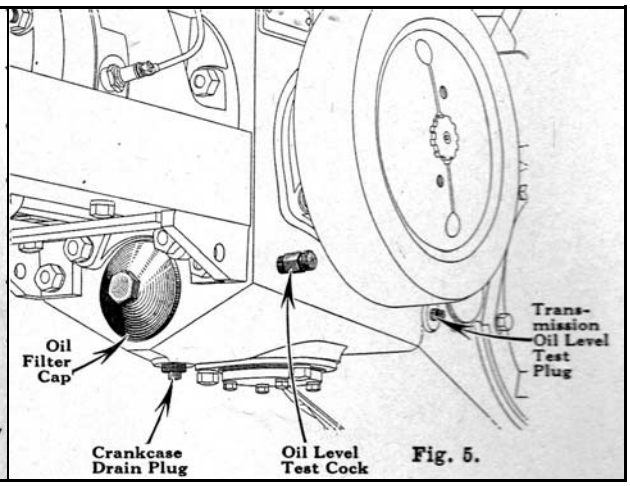


Fig. 1-4. Oil Level Testing (2), Oil Filter Crankcase Drain

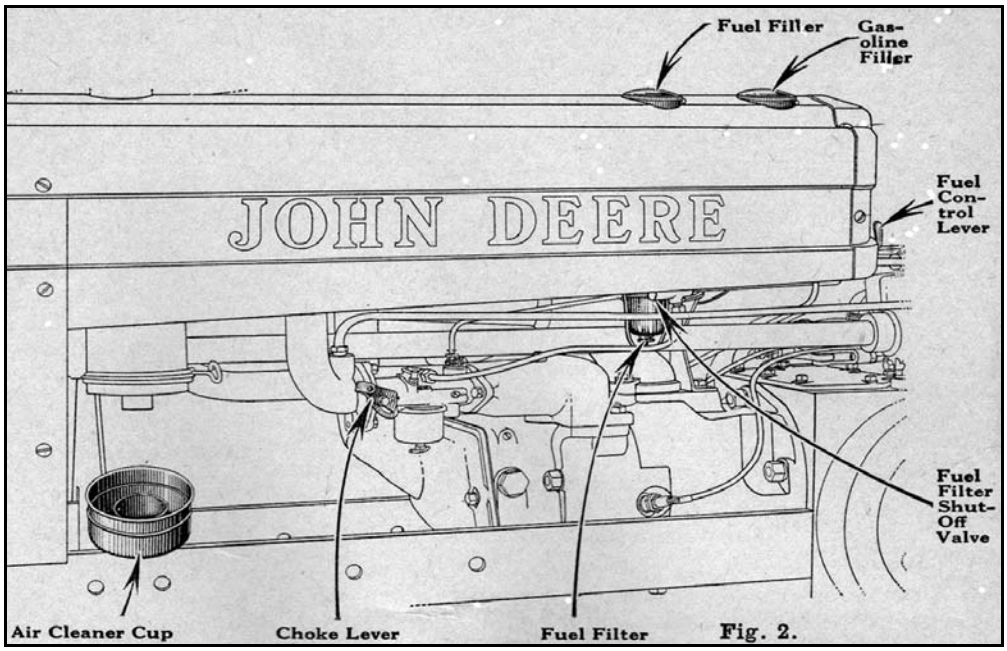


Fig. 1-5. Engine Fuel and Air Systems

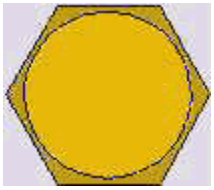
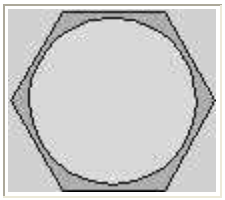
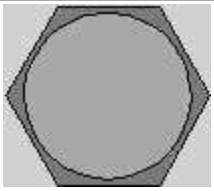
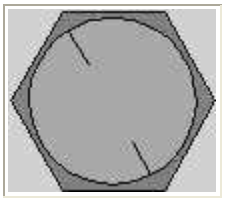
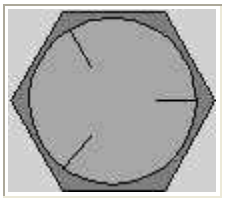
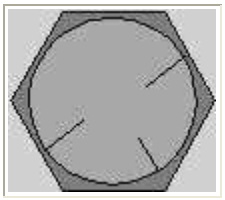
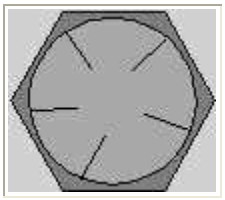
Appendix 1, page 2

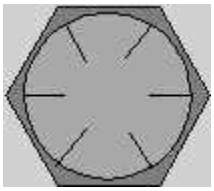
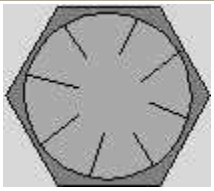
Service Manual Deficiencies
(I&T JD-4 Shop Service Manual)

Paragraph	The Issues
110	**Flywheel End Play** -- The specification is called out with no instructions how to do it. In accord with Dir. No. 214 (repeated in Dir. No's 248 and 276); "End play can be taken out of crankshaft by loosening flywheel bolt nuts and inserting screwdriver in groove near end of crankshaft through slot in flywheel and prying toward the tractor." End play shall be from 0.005 to 0.010 inch. To take it all out may result in damage to the L.H. Main Bearing (FSB 96-S, 4-15-39).
110	**Flywheel Registry with Crankshaft** -- If registry marks are absent, obliterated, confusing or just "out of view," turn the crank until the flywheel side piston (No. 1) is at top dead center (power stroke or exhaust stoke - it don't matter). Install flywheel so that the letters L.H. IMPULSE is at 3:00 o'clock.
222	**Withdraw Power Shaft with Bearings and Gear** -- The first sentence implies power shaft along with bearings and gear can be withdrawn from the main case without removing rear cover. THIS CANNOT BE DONE! See Chapter 4, Closure of Transmission and Differential Cavity.
222	**Lacks Cautionary Statement** -- Inserting power shaft assembly and drawing the mounting bolts down **may result in casting fracture** if there is sufficient interference between the power shaft driving gear and driven gear. If interference exists, a sliding shaft adjustment must be made PRIOR to hard installation of the power shaft assembly.
222	**Gear Heel and Backlash Settings** -- Methods outlined in the SM are a bit questionable and arbitrary. However, so long as the precaution above is taken, either method will produce a satisfactory result.
256	**Brake Drum Reference Snap Ring** -- During disassembly of the rear axle housing assembly, instruction to remove snap ring is OMITTED. See Chapter 4, Disassembly of Rear Axle Housing Assembly.
239, 240	**Differential End Play** -- The requirement and procedure are OMITTED. See Chapter 4, Differential Assembly Adjustment.

Appendix 2

Standard Torque Values

SAE Grade	Markings	Tensile PSI	Material	5/16	3/8	7 / 16	1 / 2	9 / 16	5 / 8	3 / 4	7 / 8
Brass		60,000	Copper 63% Zinc 37%	9	17	27	37	49	78	104	160
Stainless		72,000	AISI 303	10	18	28	40	54	80	117	180
2		74,000	Low Carbon	12	20	32	47	69	96	155	206
3		100,000	Medium Carbon	17	30	47	69	103	145	234	372
5		120,000	Medium Carbon Heat Treated	19	33	54	78	114	154	257	382
6		133,000	Medium Carbon Tempered	24	43	69	106	150	209	350	550
7		133,000	Medium Carbon Alloy	25	44	71	110	154	215	360	570

8		150,000	Medium Carbon Alloy	29	47	78	119	169	230	380	600
10		160,000	High Carbon Case Hardened	33	54	84	125	180	250	400	640

Safety Notes

These values are given in lb-ft and apply to clean smooth lubricated threads on NEW fasteners.

The nut and washer must have equal or greater rating then the bolt.

Consult your manual for material type.

The values are for the fastener not the assembly. Some assembles cannot with stand the maximum clamping force.

The values for fine treads are slightly higher.

Compiled By Chris Klossner

Bolt Diameter vs. Thread Count per Inch

UNC (Coarse)	UNF (Fine)
1/4 - 20	1/4 - 28
5/16 - 18	5/16 - 24
3/8 - 16	3/8 - 24
7/16 - 14	7/16 - 20
1/2 - 13	1/2 - 20
9/16 - 12	9/16 - 18
5/8 - 11	5/8 - 18
3/4 - 10	3/4 - 16

Appendix 3 - Marketplace

"It Pays to Shop Around!" i.e., Buyer Beware!

Just because they are listed here don't imply a warranty of their goods and/or services!

Section 1 – Tractor Parts in General

Specializing In JD "H" Parts

Dave Cook, Washburn WI 54891, (715) 373-2092, e-mail: dcook000@centurytel.net
Heartland Tractor Parts (Russ Schworer), Parkville MO 64152, (816) 587-4747 [AKA Paul's Rod & Bearing].
Detwiler's Tractor Parts, Spencer WI 54479, www.parts4tractors.com
Steiner Tractor Parts, Lennon MI 48449, www.SteinerTractor.com

John Deere Parts - General

Your local John Deere Ag Dealer, via "jdparts" Homepage – Google this term to sign up!
The Old Tractor Company, Franktown CO 80116, (303) 663-5246, www.theoldtractorcompany.com
Pete's Antique Tractor Salvage, Inc, Anamoose N D 58710, (800) 541-7383, www.petestractor.com
Detwiler Tractor Parts, Spencer WI 54479, (715) 659-4252, www.detwilertractor.com
Steiner Tractor Parts, Inc, Lennon MI 48499, (800) 234-3280, www.steinertractor.com
K&K Tractor Parts, Shelbyville IN 46176, www.kkantiquetractors.com
2-Cylinder Plus, Conway MO 65632, website = 2cylplus.com
RN Johnson, Walpole NH 03608, www.rnjohnsoninc.com
Wallace Tractor Company (Bruce), Mendenhall MS 39114, (601) 847-3844
Charles Dugan, Leonardville, Kansas (785) 293-4992
Larry Baker, Crossville, Tennessee (931) 248-2782
Marlin Smith, Panama, Iowa, (712) 489-2570
Shephard Tractor Parts, Downing, Wisconsin (715) 265-4988
Triple "G", Alden NY 14004, (716) 542-3175
Dengler Tractor Co., Middletown OH 45042, (513) 423-4000
Martin Parts & Repair, Morgantown PA 19543, (610) 913-6299

Unusual "B", "D" & "GP" Stuff

Bob Lovegrove, Fairmont NE 68354, (402) 282-7394 (B)
Don Selle, Turtle Lake WI 54889, (715) 986-2451 (B)
Kevin Stobler, Barto PA 19504, (610) 845-3668 (D & GP)
Don Duffner, Buxton ND 58218, (701) 942-3102

Salvage Yards

To locate a salvage yard near you, try a variation of www.adeptr.com as outlined below, but you must enter the full URL. Example: http://www.adeptr.com/Mi.htm is the entry for locating yards in the State of Michigan (MI). You MUST enter the state abbreviation in special form; 1st letter a capital letter, the 2nd in lower case as in "Mi" for Michigan, "Ar" for Arkansas, or "Ny" for New York.

Section 2 – Specialty Goods & Services for Tractors

Books (also E-Books) for Model "H" Tractor

Pat Browning, Deland FL 32724, (386) 624-7916 or (830) 627-0430, www.jdhpubs.com, www.blujay.com

Carburetors & Magnetos

Robert's carburetor Repair, Spencer IA 51301, (712) 262-5311, www.robertscarbrepair.com
Magneeders, Carthage, MO, (417) 358-7863, www.magneeders.com
Burrey Carburetor, Fort Wayne IN 46716, www.burreycarb.com
Branson Enterprises, Machesney Park, IL 61115, (615) 633-4262
PopinJohn, Kerhonkson, NY 12446, Mike Shelby, (845) 626-5870, www.popinjohn.com

Carburetor Drill Bit Sets (JD-H)

Pat Browning, Deland FL 32724, www.jdhpubs.com, (386) 624-7916

Decals

Jorde's Decals, 935 Ninth Avenue NE, Rochester MN 55906, (507) 288-5483, www.jordedecals.com
K&K Tractor Parts, Shelbyville IN 46176, www.kkantiquetractors.com

Electrical System Components

Agri-Services (Wiring Harnesses), Alden NY 14004, (716) 937-6618, www.wiringharnesses.com
Classic Generator (Delco-Remy), Midlothian TX 76065, (817) 473-1448, www.classicgenerator.com
John R. Brillman, (Wiring harnesses & plug cables), Mt Jackson VA 22842, (888) 274-5562. www.brillman.com

Fuel Tank Liners (Internal Coating)

(Red Kote) Damon Industries, Inc, Alliance OH, (800) 362-9850, (Try O'Reilly Auto Parts)
(Kreem) Kreem Products, Somis, CA (805) 386-4470, (Some NAPA stores)

Gauges

Evergreen Restoration, Jerry Trcka, Spooner WI 54801, (715) 635-8629, E-mail = jdgauges@yahoo.com

Governor Bearings, JD7150 (for H, R, 80, 820/830)

Pat Browning, Deland FL 32724, (386) 624-7916, www.jdhpubs.com, www.blujay.com

Grille Screen (See also Sheet Metal)

(Pre-formed) Richard Duane, Stevensville MD 21666, (410) 643-2899
(Flat Stock) Heartland Tractor Parts, Parkville MO 64152, (816) 584-4747
(Flat Stock) IPCO Machine, Mansfield OH 43358, (937) 355-4910

Grill & Hood (Sheet Metal) Bolt Sets

Early Styled Tractors (With Pan Seats) A, B, D, G & H, Pat Browning, Deland FL 32724, (386) 624-7916
Later Styled Tractors (After Pan Seats), Correct Connection, Rockwood PA 15557, (814) 926-2777
Steiner Tractor Parts, Lennon MI 48449, www.steinertractor.com

Machining + Engine Parts + Babbitt Works

Heartland Tractor Parts (Russ Schworer), Parkville MO 64152, (816) 587-4747
Triple G Service, Alden NY 14004, (888) 720-0830
Berry Cam Service, Lester Prairie MN 55354, (320) 395-2377

Magazines

Green Magazine, 2652 Davey Rd, Bee NE 68314, (402) 643-6269, www.greenmagazine.com
Two Cylinder Magazine, Grundy Center IA 50638, (319) 345-6060, www.two-cylinder.com
Yesterday's Tractors (on-line), www.ytmag.com
Tractor Shop & Little Green, Bee NE 68314, (402) 643-6269

Magnetos & Carburetors (*see also* Electrical System Parts)

Robert's carburetor Repair, Spencer IA 51301, (712) 262-5311, www.robertscarbrepair.com
Magneeders, Carthage, MO, (417) 358-7863, www.magneeders.com
Burrey Carburetor, Fort Wayne IN 46716, www.burreycarb.com
Branson Enterprises, Machesney Park, IL 61115, (615) 633-4262
PopinJohn, Kerhonkson, NY 12446, Mike Shelby, (845) 626-5870, www.popinjohn.com

Manuals for John Deere "H"

Pat Browning, Deland FL 32724, (386) 624-7916, www.jdhpubs.com, www.blujay.com

Manuals for All Other John Deere Tractors

Deerely Departed, Milan IL 61264, www.DeerelyDeparted.com
Ed Tucker, Lawrenceburg IN 47025, (812) 537-4622
John Deere Distribution Service Center, Moline IL 61266-1086, 1-800-522-7448

Radiator Bolt Sets

All 2-Cyl tractors, Pat Browning, www.jdhpubs.com, (386) 624-7916, www.blujay.com
Steiner Tractor Parts, Lennon MI 48449, www.steinertractor.com
Correct connection, Rockwood PA 15557, 9814) 926-2777

Sheet Metal Bolt Sets

Early Styled Tractors (With Pan Seats) A, B, D, G & H, Pat Browning, Deland FL 32724, (386) 624-7916
Later Styled Tractors (After Pan Seats), Correct Connection, Rockwood PA 15557, (814) 926-2777
Steiner Tractor Parts, Lennon MI 48449, www.steinertractor.com

Sheet Metal (Grilles/Hoods/Orchard)

(JD-H Grilles) Pat Browning, Deland FL 32724, (386) 624-7916, or (830)-627-0430, www.jdhpubs.com
Dave Geyer, Oxford IA 52322, (319) 628-4257
Craig's Welding, Mentone IN 46539, www.craigwelding.com/
Detwiler's Tractor Parts, Spencer WI 54479, (715) 659-4252, www.detwilertractor.com
(Medallion & Dash) Plan ahead -- don't wait until last minute & watch eBay

Shutter Assemblies/Curtain Guard

Tim Sieren, Keota IA 52248, (319) 698-4042
Charles Krekow, Marcus IA 51035, (712) 376-2663

Shutter & Fan Shroud Bolt Sets

Pat Browning, Deland FL 32724, (386) 624-7916 or (830) 627-0430

Stainless Steel Products

Crum Equipment, Athens PA 18810, www.crumequip.com

Steering Parts (Sector Gears, Eccentric Bushings, etc.)

Richard Duane, Stevensville MD 21666, (410) 643-2899

Steering Wheel Repair

Minn-Kota Repair, Inc., Ortonville MN 56278, (320) 839-3940. www.minnkotarepair.com
McGrew Equip. Inc., New Paris IN 46553, 1-866-521-9515, www.mcgrewtractorparts.com

Synthetic Enamel Paint Hardener (For use with JD paint)

Martin Senour (Sherwin Williams) – FH601 (See your local NAPA or Sherwin Williams dealer)
Check also with your Deere Ag Dealer!

Tires and Replacement Rims

Cross Manufacturing, Asbury MO 64832, (417) 842-3405 (rims)
Detwiler Tractor Parts, Spencer WI 4479, (715) 659-4525 (Wheels & wheel repair)
Friedrich Tire & Rim, Chanhassen MN (612) 940-2800, (tires), website = friedrichtire.com
M.E. Miller Tire Company, Wauseon OH 43567, (419) 335-7010, (tires and rims), www.millertire.com
Nebraska Tire, Firth NE, (800) 234-5242, (tires), www.nebraskatire.com
Tucker's Tire Co., Dyersburg TN, (888) 248-7146 or (731) 285-8520, (tires), www.tuckertire.com
Wilson Farms, Fredericktown OH 43019, (740) 694-5071 (rims)
Wilson Tire, Marengo OH 43334, (740) 625-6894 (tires & rims)
Your local Firestone or Goodyear Tire store, of tire outlet stores

Tractor Wheel Repair

Detwiler Tractor Parts, Spencer WI 54479, (715) 659-4525, www.parts4tractors.com
Nielson Spoke Wheel Repair, Estherville IA 51334, (712) 867-4796

Appendix 4, page 1 of 3

Gaskets for your John Deere "H" tractor

See PC304 Parts Catalog. Four gasket sets bearing JD part numbers are listed on pages 46 and 47. At this writing, only AH1160R (now RE524342) and AH1163R are available from Deere & Co. While the RE524342 set may be a fair buy, the price for the AH1163R is far too high. See "substitute" listing for AH1163R Governor Overhaul in Chapter 3. You are encouraged to buy RE524342, widely available from both Deere and a host of after-marketers. Beyond this, you should buy the individual gaskets that you need. Or, chose to buy select gaskets -- the larger ones, and make the others as you go along. I recommend at least being prepared to make a gasket or two -- you never know!

If you choose to make gaskets or find needed gasket obsolete, use 1/64-inch-thick paper stock for thin gaskets, 1/32-inch-thick paper stock for medium gaskets, and 3/64-inch-thick paper stock for thick (heavy duty) gaskets such as for right and left crankcase main bearing housings. Gasket-making can be fun, but it is not for everyone! In some instances, however, you may be forced to consider making gaskets as sources dwindle.

As you proceed through your project, you will come across gaskets described as thin, medium, or thick (varied thickness), many of which were combined with shims. With the passage of time, it appears (to me) that Deere literature has them sort of "flowing together" to the point where it is had to tell a shim from a gasket. And on the JDParts website, at least one of these was described as a shim, but its material was paper! These ill-defined combinations will be found where gaskets are added or taken away in the act of making an adjustment for bearing load or gear mesh. Part numbers so affected include H158R-H160R, H162R-H164R, H270R-H272R, H397R-H399R, H413R & H414R, and finally H427R & H428R. Bottom line -- you must protect and preserve all shims, and be prepared to make a few paper gaskets. The raw, paper gasket material is readily available at most auto parts stores, and along with a simple hole punch set from (say) Harbor Freight, scissors and a sharp knife, you are in business!

RE524342 Gasket Set - Valve, Ring & Cylinder Replacement

264R	Lead washer - cylinder (Oil lead) Stud
321R	Gasket - Carburetor to manifold
B369R	Lead washer - cylinder head stud
D1034R	Packing - ventilator pipe
H108R	Gasket, block to main case
H111R	Gasket - cylinder head
H113R	Gasket - Head water inlet
H137R	Gasket head to manifold
H179R	Gasket, Block water outlet
H266R	Gasket, Tappet lever shaft bearing
H501R	Gasket, C/C cover
H503R	Gasket, tappet cover

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AH1161R Gasket Set - Crankshaft & Bearing Replacement
H230R (Cork oil seal, crankshaft)
H233R (R. main bearing housing, thick)
H237R (L. main bearing housing, thick)
H239R (L. main bearing cover)
H245R (R. camshaft bearing housing)
H248R (L. camshaft bearing housing for 1000 - 9999)
H350R (Dust shield for 1000 - 13153)
H351R (Reduction gear cover -- large gasket)
H362R (Pulley brake bearing)
H501R (Crankcase cover -- cork -- included in RE524342 basic engine set)
H741R - 2 ea (L. camshaft bearing housing for 10000 & up)
H751R (Dust shield for 13154 & up)

AH1162R Gasket Set - Transmission & Rear End
H328R (Rear transmission cover - cork)
H351R (Reduction gear cover - also in AH1161 listing above)
H362R (Pulley brake bearing - also in AH1161 listing above)
H376R (Top transmission cover -- 1000 - 9999)
H613R (Felt washer, PTO shifter shaft)
H715R (Gear shifter shaft bearing)
H719R (Fulcrum ball socket)
H720R (Top transmission cover -- 10000 & up)
H723R (Leather - gearshift fulcrum)
H159R (4 ea) shims for slider gear shaft right bearing housing -- **save** old ones for reuse.
H164R (2 ea) shims for slider gear shaft left bearing housing -- **save** old ones for reuse.
H602R (4 ea) shims for PTO shaft rear housing bearing -- **save** old ones for reuse.

AH1163R Gasket Set - Governor Overhaul **[NOTE: See Governor Overhaul, Chapter 3]**
A5272R (Magneto-to governor case)
F1072R (2ea, small rubber packing for ventilator pipe)
H387R (Governor-to-main case)
H399R (2ea, Governor left bearing housing)
H501R (Crankcase cover -- included in RE524342 basic engine set)
H397R (10 ea) shims for left governor bearing housing -- **save** old ones for reuse.
H413R (fan shaft-to-governor bearing housing, thin paper)
H414R (10 ea) shims for fan shaft-to governor bearing housing - **save** old ones for reuse.

Gaskets, packings & cushions you may need -- not found in the four basic sets -- Some you should just buy. I've marked the ones where **BUY** recommended.
24H234R (2 ea, Copper washer for tappet shaft)
2497 (WICO C Cap)

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2504 (WICO C Cover)
321R (Carburetor-to-manifold) -- **Buy** with carburetor parts
5618 (WICO X Cover)
A393R (Packing, fan spring)
A519R (Oil filter ring gasket)
AH633R (2 ea, Rear axles seal, inner)
AH754R or H1033R or D1737R (Felt washer, outer power shaft, see power shaft options)
B54R (Crankcase breather - lower)
B246R (Oil pump gear section) ← **Definitely BUY this one!**
B293R (Packing, rear fan)
B297R (Packing, front fan)
C1778R (Sediment bowl) -- **Buy** with carburetor parts
D2122R (Packing gasket, 3-way fuel cock)
D1851R (2 ea, Fuel cap)
H142R (Felt gasket, air cleaner-to-hood)
H170R (2 ea, Radiator, core-to-tank) -- large gaskets
H175R (Upper tank-to-inlet elbow)
H199R (Cork washer, front pedestal, upper)
H203R (4 ea, Felt washers, front wheels)
H205R (2 ea, Hub cap, H, HWH - H1000-47795)
H254R (Cam follower shaft - right)
H270R, H271R & H272R (Steering shaft @ worm gear end)
H290R (Oil filter head to cover)
H294R (Alum washer, oil filter nut)
H316R (Oil pump-to-main case)
H356R (Copper washer, clutch fork shaft)
H423R (2 ea, Felt washer, outer rear axle)
H429R (2 ea, Felt washer, inner rear axle)
H476R (Cushion for front tank support)
H477R (Cushion for rear tank support)
H499R (2 ea, Cushion or pad between medallion and hood)
H416R (Oil filler on governor case)
H505R (Crankcase breather - upper)
H546R (Cork washer, front pedestal, lower)
H613R (Felt, PTO shifter crank shaft)
H764R (Cork washer, front pedestal, HN, HNH)
H952R (2 ea, Rubber cushion for rear tank support)
H1019R (Gasket, radiator cap)
H1024R (2 ea, Hub cap, H, HWH - H47796-up)
H1061R (Packing -- manifold-to-exhaust pipe)
R10030R (Carburetor bowl gasket)
R20249R (Oil filter body to head)

Appendix 5 - Engine, page 1 of 4

Remove & Replace Crankshaft, Renew Main Bearings

To be performed before hand ➔

a. Drain engine oil and remove crankcase cover.
b. Remove tappet cover, loosen tappet adj. screws and remove push rods.
c. Remove connecting rod caps -- move pistons forward.
d. Remove Flywheel.
e. Remove Clutch and belt pulley.
f. Remove Dust Shield and Reduction gear cover.

To remove crankshaft - - -

1. Totally disconnect and remove oil line to left main bearing inside crankcase.

2. Remove left side H238R main bearing cover and AH572R flywheel spacer (oil slinger).

3. Remove left bearing housing assembly, AH808R.

4. Remove right bearing housing assembly, AH807R

5. Withdraw crankshaft from crankcase -- out the flywheel side.

6. Now, perform cleaning and visual inspections of the entire crankcase region and of H238R cover, and AH572R spacer. Plan to replace H230R oil seal.

Preparation - - - H230R oil seal needs a 24-hour soak in engine oil before installing into H238R cover. Put into oil @ _____ on _____.

To Install Crankshaft - - -

7. Insert crankshaft into crankcase cavity. Use pads and shop rags to protect bearing surfaces.

8. Locate H236R thrust washer. Ensure it is fitted into its slot (smoothest side toward the crankshaft gear) in AH808R L.H. main bearing housing. Install AH808R, washer and gasket with gasket cement (Permatex 2B, 3 or equivalent), pre-oiling the bearing before installation.

9. Install R. H. main bearing housing, AH807R and gasket with gasket cement, pre-oiling the bearing before installation.

ALIGNMENT -- Mesh crankshaft gear and camshaft gear so that (valve) timing marks are in register. These marks are found on the pulley side of these gears. QC _____

Appendix 5 -- Engine, page 2 of 4

Remove & Replace Crankshaft & Renew Main Bearings

CAUTION -- *Do not force* bearings and shaft together -- resistance or binding indicates alignment failure.

10. Draw up fasteners quite snugly, but limit torque to prevent "squeezing" gasket out from between bearing housing and main case. The absolute, not-to-exceed torque limit is 78 ft-lbs. See "full-torque" warning note in Chapter 3 under "Gasket Sealers."

11. Reconnect oil lines to both left and right main bearing housings, inside crankcase. QC ____

12. Apply a few shots of spray lube to rod journals to prevent corrosion.

13. Install pre-soaked H230R oil seal into AH572R flywheel spacer. Use care to protect seal.

14. Install AH572R flywheel spacer. When installing AH572R spacer containing the new oil seal, do not rotate the spacer on crankshaft until and unless it is fully against the main bearing because to do so may damage the new seal by rotation on the splines of the crankshaft.

Orientation is of significance because flywheel pin must align with, and fit into notch on spacer. The spacer must turn with the flywheel to "sling" oil to a recovery channel; thus the nickname "oil slinger." Crankshaft end is 10-splined: 10 ridges and 10 valleys. The "V" mark is on a ridge. From that ridge, *count clockwise to the 5th valley*. Install AH572R spacer so that one of its notches is in register with this 5th valley. There should be little or no further rotating of spacer when installing flywheel; the flywheel drive pin and spacer notch should be in line. QC _____

15. Install H238R main bearing cover and H239R gasket with gasket cement. Tighten 3/8 inch cap studs. Do not squeeze gasket out. The absolute, not-to-exceed torque limit is **33 ft-lbs**.

16. Perform cam gear-to-crankshaft gear backlash adjustment. See also page 4 of this appendix. Apply gasket cement to H741R left camshaft gaskets at this time, and **limit** these bolts and/or nuts to a torque of **between 12 and 15 foot-pounds.** The objective is tight enough to secure and prevent leaks. If you over-tighten these fasteners, distortion of the H 742R cover will increase chances of a leak. Ref "full-torque warning note in Chapter 3 under "gasket sealers."

17. Use solvent and toweling to wipe away excess gasket cement in vicinity left and right bearing housings, and flywheel cover on left side.

18. Tasks completed on _____. QC _____

Appendix 5 - Engine, Page 3 of 4

Basic Engine Timing

Conditions: Crank, block and ringed pistons are installed per Appendix 6. Cylinder head IS NOT installed, and camshaft has been removed for renewal of bearings and seal.

Definitions: Basic engine timing means establishing a specific relationship between flywheel, crankshaft, camshaft, and governor shaft; and the resultant magneto drive flange orientation.

Purpose: Install camshaft. Establish timing; camshaft to crankshaft and camshaft to governor.

Install Camshaft:

a. Install AA6619R bearing, B334R snap ring, and AH583R seal into right bearing housing.
b. Insert camshaft from pulley side -- bringing shaft into and through cam gear.
c. Ensure cam gear (pulley side on hub) and camshaft "V" marks are in register. QC _____
d Install left camshaft brg hsg with preassembled bearing and snap ring (See **setting**, next pge).
e. Ensure cam gear (pulley side - tooth region) and crank gear "dot" marks are in register. Install washer and nut on end of camshaft. QC _____
f. Install right bearing housing with bearing and seal -- be careful here. Protect the seal.
g. Perform cam gear backlash procedure (see next page) -- secure all fasteners (tighten, cotter pins, bend lock plates as required). QC _____

Camshaft-Governor Timing:

a. Verify the "V" mark on the flywheel is in register with "V" mark on crankshaft. Alternatively, see page 3 of Appendix 1 to verify flywheel relationship to crankshaft.

b. Rotate flywheel until mark on cam gear (flywheel side) is at roughly 12:00 o'clock. Then finely adjust crank (by rotating flywheel) so that "L.H. IMPULSE" on flywheel is in register with raised mark on left side sliding shaft bearing housing, or @ 3:00 o'clock (No. 1 @ TDC). QC ____

c. When installing governor, verify that the slot in the magneto drive flange (right side of governor) is parallel to the top of the crankcase. QC _____.

NOTE: The "dot" marks on the governor gear and camshaft gear (flywheel side - in tooth region) should also be in register. During this installation, however, the governor gear mark is hard to see. And so with engine No. 1 @ TDC, magneto drive flange horizontal is sufficient!

Fully-Assembled Engine:

"**No. 1 Just Fired Position --** No. 1 TDC Combustion stroke is sensed by a buildup of compression at spark plug hole on left side while rotating the engine by rolling the flywheel forward. Taking engine to this point and then a fine adjust by setting the flywheel "L.H. IMPULSE" to its corresponding raised mark ("mark") on the sliding shaft bearing housing places the engine at "**No. 1 @ TDC**" position.

Valve Timing Test (Service Guide, Para 2-10) -- With tappet cover removed, tappet clearance adjusted properly, and flywheel installed correctly, rotate flywheel until left exhaust valve gap is 0.000. "L.H. EXHAUST" should be on the "mark" +/- 1/2 inch. If test fails, see Service Guide, Para 2-11 for valve timing.

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Camshaft Backlash Adjustment Procedure (H10,000 up)

(FSB 145-S, May-June 1943))

Camshaft Backlash Adjustment, done during early assembly of the engine -- Welcome to one of those trial and error jobs as relates to the "H" tractor. We are dealing with an eccentric bearing housing (H707R) that contains the left camshaft bearing. The idea is that by rotating the bearing housing a quarter of a turn at a time, the camshaft is moved closer to, or further from, the crankshaft.

Note: The camshaft must be free of all forces during this procedure (no push rods installed). Therefore, if you attempt this adjustment on a completed tractor, you will need to remove the crankcase and tappet covers, loosen the tappets, and eliminate push rod tension at minimum.

While some change surely occurs in the relationship between the camshaft gear and governor gear, no measured observations of this relationship are made.

Next, observe that of the four corners of H707R, one is square. This square corner serves as a **position indicator,** and is placed in the upper forward position at the factory. This setting is the r**eference position,** and provided between 0.004 and 0.008 inches clearance between the gears.

When the eccentric bearing housing is rotated clockwise one quarter turn (position indicator in upper rear corner), the crank and cam gears are 0.005 to 0.007 closer together. This in most cases will be enough to compensate for wear. Where more wear than normal has occurred, it may be necessary to move the eccentric bearing housing to the second position (position indicator in lower rear corner). This places gears 0.010 to 0.014 closer than they were when new.

There are only two adjustments aside from the factory setting. If rotated clockwise one more quarter turn, (position indicator in lower front corner) the gear mesh returns to the same dimension as the original factory setting. However, you will notice that the position indicator will strike the main bearing housing indicating that this position was never intended to be used.

Setting -- Here is the good part. Pick a setting. If you recorded (Journaled) the original orientation of the square corner during disassembly, begin with that setting. If not, begin with the factory setting.

Being certain of cam gear-to-crank gear registry, install the bearing, tighten the big camshaft nut, and at least two (of four) of the 3/8 nuts securing the H707R housing. Observe the amount of backlash. Measure by how much of a tooth on the cam gear goes past a certain point of the main case. Record this value along with the orientation of the position indicator.

Then loosen the big nut and the two 3/8 nuts, withdraw the bearing housing, and make a quarter-turn clockwise (CW) rotation. Being certain of cam gear-to-crank gear registry, reinstall the bearing, tighten the big nut, and 3/8 nuts. Verify that the amount of backlash is the same as above. Record this value along with the orientation of the square corner. Repeat until satisfied. <u>The criteria is to adjust for minimum backlash, but you must have some</u>!

Appendix 6, page 1

Install Cylinder Block & Pistons

Preliminary

For this procedure, and for installing cylinder head, it is best if flywheel is already installed. If, for some reason, this is not feasible, (1) use a strap wrench when it is necessary to turn the crank, or (2) temporarily install flywheel as it will be required to position crank during connection of rods to crankshaft and adjusting tappet push rods.

Procedure

1. Chase all threaded holes and studs with die nut and tap, and use air hose to clear debris from holes.

2. Shoot some lube into the block. The cylinder walls should be moist with oil.

Choice: One can install the block first and then insert ringed pistons, or insert ringed pistons into the block followed by installing block with pistons and rods preinstalled. This procedure outlines the second alternative. Either way, a helper will come in handy to position the cylinder block up to the main case.

3. Install ringed pistons into block. Most JD pistons will carry a "TOP" mark to indicate which side should be UP when installed. If no such mark is detected, be sure piston is installed with the holes in the oil ring groove (or land) UP. **Replication**: If connecting rods are stamped to identify No. 1 and/or No. 2, ensure they are reinstalled accordingly.

NOTE**:** Piston Pins and Bushings **--** Also referred to as **wrist pins**, the pin diameter is called out at **1.104 to 1.105 inch** for the "H" tractor. You should have a thumb push fit in the un-bushed piston and have a clearance of between **0.0002 and 0.002 inch** in the connecting rod bushing.

4. Apply Permatex 2B, 3 or equivalent to gasket, slip gasket onto main case studs, and apply Permatex 2B to second side. A suitable alternative is to apply bearing grease to one side only.

5. Lay block down into front support and slide onto the main case mounting studs. Exercise care to ensure that connecting rods enter crankcase without interference, and that they do not scratch or mar journals on the engine crank.

6. Secure block in place. Install all fasteners before tightening any of them. Apply anti-seize to main case studs and to 9/16 x 1-1/2 inch cap screws. Secure 9/16 inch fasteners (bottom) to a torque not-to-exceed **115 foot-pounds**, and all other fasteners (5/8") to a torque not-to-exceed of **150 foot-pounds**. See "full-torque" warning note in Chapter 3 under "Gasket Sealers." QC _____

7. For the 5/8 inch fasteners which cannot be reached with your torque wrench, tighten them to the best of your ability with ordinary box-end wrenches. In layman's terms, they should be really tight!

8. In the crankcase, connect and secure oil line from oil pump to line in 3/4 inch block stud. QC_____

9. Attach connecting rods to crankshaft in accord with commentary outlined in Chapter 3 to attain a running clearance of from **0.001 to 0.003 inches**. See also Plastigage, and Trial and Error Method (Chapter 3) to establish "running clearance." Observe that the thickness of the thinnest connecting rod bearing shim is **0.003 inch.**

10. Tighten connecting rod bolts to a torque of **62-1/2 foot pounds**. Then tighten as needed to insert cotter pin. **NOTE**: See "Plastigage, and Limits on Usage" in Chapter 3. QC _____

11. Install cotter pin and spread its legs. QC _____

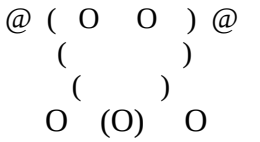
Appendix 6, page 2

Install Cylinder Head, & Manifold

1. Soaking the cylinder head gasket in engine oil is obsolete technology. Apply Coppercoat (K&W) or Copper Spray-A-Gasket (Permatex) immediately before installation. Or - install the gasket dry! See "Head Gaskets" in Chapter 3.

2. Install gasket with smooth side toward block. If both sides of head gasket seem smooth, then check the firing ring – the crimped border around each cylinder bore hole. You will find one side of the ring smooth. This side goes to the block. The other side has the roll crimp and goes to the head. ➔Use new lead washers under the nuts in center and on top, inside the tappet cavity. Use 3/4 inch copper washer (this washer may be aluminum, copper, or even lead) on oil lead stud, bottom and in the center, inside the tappet cavity. These "soft" washers prevent galling so that accurate torque readings are attained.

3. Tighten stud nuts from *center outward.* Draw up gradually. Step-torque these fasteners, going from inside to out in increments of 20 - 25 foot pounds, eventually arriving at a torque of **96 foot pounds** for all except the 3/4 inch oil lead stud which should be tightened to **180 foot-pounds** of torque. **Do not over-tighten these fasteners!**



NOTE: These two points @, require a crowfoot wrench and nice, sharp nuts (not rounded).

QC _____

4. Install manifold using 7/16 x 4-3/8 studs w/nuts. Apply anti-seize compound to studs. Turn studs into head a distance 5/8 +/- 1/32-inch (1.5 dia rule). Resultant stud extension should be approx. 3-3/4 inches up from engine head. Fasten with nuts only (no lock washers); Maximum torque is **54 ft-lbs**. [Stop at 35 to 45 ft-lbs if using brass nuts]. QC ____.

5. Install push rods in same locations they were in during disassembly. Ensure that each is seated into its cam follower.

NOTE: For new build-up, crankcase cover is not installed. Otherwise remove the crankcase cover when installing push rods so you can see to ensure the rods are guided into cam followers.

6. Install tappet levers, tappet shaft and **tappet oil line**. Verifying push rod seating into cam followers, set tappet gap to between **0.017 and 0.018 inch (room temperature).** Inspect to verify that the tappet oil line is installed. QC_____

NOTE -- Setting tappets to specified setting of **0.015 + 0.002, or 2 thousandths over spec.** is a long-standing practice of John Deere service men. When at operating temperature, the gap will be as specified!

To adjust tappets (The JD "H" engine has no "low cam" position), (1) With tappet cover and both spark plugs removed, (2) Turn flywheel until left-hand (No. 1) piston is at end of its compression stroke (L.H. IMPULSE will be @ its mark) and adjust both tappets on the left side, (3) Turn flywheel forward until right-hand (No. 2) piston is at end of its compression stroke (one-half revolution from above) and adjust both tappets on right-hand side.

7. Turn engine over to ensure all is free, and that valves are working normally. Make sure all the oil lines are properly secured, and be especially careful to inspect and confirm clearance between oil lines and the moving parts (crankshaft and connecting rods). Run compression test and record readings for each side in your journal. QC _____

8. Prepare gasket for tappet cover; install the tappet cover.

Appendix 6, page 3

Clutch System & Reduction Gear Cover

(New Build up)
(Procedure and part numbers not directly applicable to S/N 9999 & below)

Preliminary -- *Pack roller bearing in pulley subassembly (S/A).*

1. **Verify oil return** -- Ensure the oil director wing on H253R cam follower shaft cover is positioned over reduction gear, and that the **oil return path** in both AH605R dust shield and the gear cover are open. QC Step _____

2. **Install AH 604R Reduction Gear Cover S/A.** Use seven (7) 3/8 x 1 inch cap screws, six lock washers and one locking plate. NOTE: This S/A must contain H284R throttle pedal S/A with cotter pin in position before mounting the AH605R Dust Shield.

Quoting the service manual and/or service guide, "When installing reduction gear cover, make certain the reduction gear cover is centered around the clutch operating sleeve."

Use the outer edge of the boss on H346R casting, which interfaces with AH605R dust shield, as a guide. Measure into the camshaft. When all measurements come out equal, this casting is centered. Tighten a couple cap screws.

QC Step _____ [Look for (1) centering, (2) H284R Pedal S/A, and (3) the lock plate for hidden cap screw].

3. **Install AH605R Dust Shield**, using drilled cap screws without lock washers; Two 3/8 x 3/4 inch long, and three 3/8 x 3-1/2 inch long. Here centering of the dust shield with respect to the camshaft is vitally important. If out of position, it will rub or scrape the clutch operating sleeve. Oil return action will be adversely affaected. Measure from at least three equally spaced directions into the camshaft to ensure it is centered. Once assured, tighten mounting cap screws for both dust shield and cover. Then prove it is centered by temporarily installing the belt pulley to test for the absence of rubbing or scraping. There shall be none, and the pulley must turn freely! Remove belt pulley assembly.

Once proof is achieved, install safety wire to secure these five cap screws. Rerun belt pulley free-turning test. QC Step _____ (Test passes, and Safety Wire).

NOTE 1: If scraping or rubbing is evident, you must repeat step No. 3 above (centering) before safety wiring.

NOTE 2: A worn out belt pulley bushing or belt pulley bearing will make this test extremely hard to perform!

4. Ensure pulley bearing is freshly packed. QC _____ (bearing packed).

5. **Install AH1104R pulley S/A**. Compare oil control interface with reduction gear cover and dust shield to ensure reduction gear cover is indeed centered. Pulley should turn freely, and there must be no detectable rubbing or scraping. This the last check. QC Step _____ (final centering check).

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6. **Snap Ring**: For H1000-9999, install A378R snap ring on camshaft. This snap ring goes between belt pulley and driving disk, and serves as a vital reference for clutch operation. See PC304 Parts Catalog.

7. **Install driving disk**. Be certain that both splined surfaces are free of dirt and/or other contaminating debris. Polish and/or file as necessary to achieve a fit – being careful to take as little metal as possible from either surface – "polish" being the keyword. This disk must be absolutely tight onto camshaft (FSB 110-S, 6-15-40). Tighten retaining bolt with air impact wrench. Install also AH 1216R adjusting disk. See Operator's Manual, page 37.

8. **Install H353R shifting fork S/A**.

9. Install and connect AH607R clutch lever and H346R operating rod S/A. Adjust IAW Operator's Manual, page 37.

10. **Pulley Brake Adjust** – This is done by leaving the clutch in the disengaged position (handle back), engine not running. Start turning the pulley brake adjustment bolt INWARD until the clutch handle begins to move forward. Only adjust the bolt in enough from here to obtain decent pulley brake action. How far you have to adjust from there depends a lot on how worn parts are. You want to use as little pulley brake bolt as possible to ALLOW maximum travel of the operating sleeve but still have solid brake action. It's a hunt for the happy medium here! Adjust per Operator's Manual, page 39.

11. **TIP**: When rebuilding or overhauling the clutch, one should make a full chase of threads for both the operating bolts and their nuts a part of the preparation procedure. The threads must offer no resistance (to turning) so as to improve sensitivity of torque during assembly in preparation for clutch adjustment.

12. **Adjusting the Clutch**: To adjust the clutch, first set the clutch lever in the engaged position; then, tighten each of the three nuts a little at a time to an equal tension. This you can determine by the effort required to turn the nuts. Now, try the clutch lever. It should go into engaged or operating position with a snap requiring some pressure. This "some pressure" is a force between 40 and 80 pounds applied at the end of the clutch lever.

13. **Alternative Method – Adjusting the Clutch** -- Engage the clutch. Tighten each nut to 4 or 5 FP and go around again to 8 or 9 FP then go around again to 12 FP and then one more time to 14 FP. Now, back each nut off about one-fourth turn and re-torque to 14 FP. Tighten each nut slightly and only until the cotter pin will insert. Now, you are ready for the clutch snap in-snap out adjustment. Try the clutch lever. If it is too difficult to release, loosen each of the three nuts by only one castellation of the nut. Now try to engage the clutch. If it is too hard to engage, loosen the three nuts by one more castellation. Be sure to adjust each nut evenly and only one castellation at a time.

14. **TIP**: Install a thinner cotter pin into one clutch bolt. Sometimes pulling all three of them by one castellation is too much. Try one or two. The small cotter pin helps you keep track of which nuts were turned. This helps fine tune clutch pressure to exactly what you want. **Journal** your work.

Appendix 7, Page 1 of 2
Renewal -- Inspection Criteria

INTRODUCTION

Throughout the publication, procedures will be presented for various parts of your tractor to take it apart, clean and inspect the components, make decisions of removing wear and repairing broken things, and for taking the tractor through final assembly. CLEANLINESS is key! Foreign matter complicates inspection and may mask defects.

DEFINITIONS

Removal is the step-by-step (if required) procedure for dismantling a subsystem or major section of the tractor. If assumptions are made, they will be listed beforehand.

Renewal is the key word meaning overhaul, remove and replace, or bring back to a new state -- all evidence of wear is taken away.

Reinstallation is in some cases a reversal of removal, but in general will be final assembly of a subsystem, or of the entire tractor.

CRITERIA

The detective's eye is always open. It is said that detectives even sleep with one eye open. Be vigilant at all stages of removal, renewal and reinstallation for evidence of wear and tear, and for any other result that makes the tractor not new and (of course) be willing to journal all findings.

Bearings -- Inspect bearings for any sign of wear, not the least of which is pitting or corrosion. Any bearing not complete (missing keepers, rollers, balls, etc.) should be replaced.

Bushings -- Inspect bushings and shafts for wear, fit, and cracks. Look for missing bushings. For bushings inside the engine and transmission, Service Guide criteria is a "free running fit." Wobble or play discernable to the naked eye constitutes a failure and must be dealt with.

Outside the engine and transmission, the Rule of Thumb for bushings generally remains a "free running fit," or better said, a "snug fit." Tolerable clearances will vary with shaft diameter (bushing ID). Part of the testing involves just plain sloppy wobble and excessive free travel of operator controls. Brake pedals and clutch linkage are likely to be the worst offenders. Limits will be set in the appropriate sections under discussion.

Guideline: For any shaft supported by a non-tapered bearing (ball or roller), or a bushing: if you can grasp the shaft and sense any radial movement, replace the bearing or bushing.

Guideline: For any pulley or gear supported on a shaft by a non-tapered bearing (ball or roller) or a bushing: if you can grasp the pulley or gear and sense any radial movement, replace the bearing or bushing.

Reminder: For all shafts supported by tapered roller or ball bearings, “free” shaft motion is limited by adjusting shim thickness at a bearing housing on either end of the shaft. This process is bearing loading.

Appendix 7, Page 2 of 2
Renewal -- Inspection Criteria (cont'd)

Gears -- Two standards:

(1) **Field Use Gear Standard --** One standard is that a serviceable gear will have no missing teeth, and no major chips. A major chip is defined as a chip over 1/3 tooth height, or 1/3 tooth width, but never both. If a totally new vintage tractor is your objective, this level of scrutiny applies.

(2) **Hobby Use Gear Standard --** A second standard assumes hobby use of a vintage tractor, and not total renewal. Gears should not have missing teeth, tooth wear must be somewhat uniform, and generally not exceed 20%. Gears missing a third of a tooth shall be considered a "missing tooth," and should be replaced. Uneven tooth wear needs to be traced for cause, the cause needs to be rectified, and those gears replaced. Over 20% loss of tooth width (wear) is a turning point beyond which replacement is generally warranted. Wear (or other cause) in gear teeth to a point where smoothness is lost is a failed gear. Where a backlash observation is called for, it shall be observable, or discernable backlash, but only enough to be discernable to the touch. Backlash and wear are not interchangeable. In the case of the fan shaft-governor interface, backlash will be discussed separately in the governor section of Chapter 3. **NOTE**: Applications of this standard should be recorded in your Journal along with reasoning for your decisions.

Threaded Parts -- Inspect threaded parts and fasteners for "riveting," cross-threading and burrs. All must be repairable to wholeness or replaced. Unserviceable threaded tapped holes in castings shall be over-bored and fitted with suitable Helicoil™ inserts, Keenserts™, or drilled and tapped to the next standard thread size if appropriate. Standard torque values and specific torque call-outs assume NEW THREAD conditions, i.e., near-zero friction between threaded parts.

Inspect every single item of hardware in the tractor right on down to weldments and clevis pins, and a make reuse, repair or replace decision for each. In areas where more specific criterion applies, you will find the additional information in that section -- e.g., gear meshing, end-play, free rotation, backlash, or bearing loading requirements.

Castings -- As cast parts are being cleaned and inspected, check for wear, abuse or misuse, and cracks. Old repairs must be inspected for soundness and serviceability. Modern rework methods of casting repair are to be considered over replacement if necessary. Repaired parts on vintage tractors are as valid as they were in the early years.

Submit all engine castings to rigorous testing looking for anything unusual -- wear, and especially for cracks. At a minimum, these will include the main case, cylinder head and block, pistons, manifold, carburetor, connecting rods, main bearing housings, radiator tanks, and water pipes.

Manifolds are especially vulnerable to lose of stock. Perform diligent inspection for small openings in this casting between the intake pathway and the exhaust channels.

Make notes in Project Journal of all findings of inspection, and in your Procurement Log for parts to be R/R.

Appendix 8, Page 1

The 1939 "H" -- A Tractor "Set Apart"

Reference the introduction to the Model "H" John Deere Tractor as relates to serial number assignment. Note that while the Parts Catalog cites part number data beginning with 1000 and up, there is only one "H" tractor below serial number 1104 that is known to have survived, that one being 1013 currently at the John Deere Pavilion. Therefore, in the analysis that follows, I will observe 1104 as the lowest "H" serial number 'out there.' From other data, we see serial numbers 9911 through 9999 were not used! Thus '39 tractors appear to range from 1104 through 9910!

NOTE: For those who visit the JD Pavilion to examine H1013, this tractor is said to be an Expo quality restoration, a very fine-looking machine! However, the restoration seems to be lacking any serious attempt to restore its authentic (or original) configuration. Genuine John Deere parts were used, by part number, but many parts evolved over time without a number change. Literally dozens of instances can be found by one having the knowledge to examine the tractor closely. Here we see the difference between a show-quality restoration using genuine parts, and an authentic original configuration restoration.

This restoration points out the real challenge for a person restoring any vintage tractor. The keys here are to gather data on your model from as many sources as you can and then cross-check the data with the contributors, and to find parts suppliers who know the tractor, will counsel with you on nuances as outlined below, and be willing to take back a part that isn't right.

For those '39 tractors out there with serial numbers 9999 and below, special care is to be taken when procuring replacement parts in select areas of the tractor. There were three major areas of change at the 9999 - 10000 break. They are the **camshaft** and all components on each end of the shaft, the **shifter section**, and the **slider shaft** and its associated components. Study the enclosed parts listing that exposes the changed parts, most coming at the 9999-10000 break, and some at different places -- all worthy of note. You just know a change is a major when a tractor's main case is changed! Less invasive changes this author knows of are described below.

Some subtle changes you will find, and which should not present great consternation are outlined below:

Brake Latch (H435R) -- Some changes were made along the way that only are evident when you compare the Deere & Co. documentation versus the tractor you have in your shed. Brake latches for instance were a bit different on the early '39 tractors; the cam diameter was less. With a smaller cam diameter, the latch fell deeper into position when the brake was set, and was often a challenge to release. The increased diameter cam versions (for H10000 and up) will fit on the '39 tractor, and the '39 version can be installed on later tractors.

Drawbar -- Early '39 tractor through 7185 had a couple differences, one in the length of the drawbar stem (it was shorter), and also some peculiarity in the drawbar support (only one crossover piece). These early tractors had the AH 508R swinging drawbar and the AH 507 R drawbar support (below). AH772R Support was made effect with H7186. Other changes continued along the way after the 1939 tractors.

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Also with H-7186 came the H675R swinging drawbar. The two holes on the left (under the belly) end of H675R permitted the drawbar to be repositioned forward and aft. This adjustment provides a "long" or "short" drawbar feature to the owner. Both AH508R and H675R can be inverted to offer "high" or "low" drawbar elevations. H675R would later give way to H1030R, easily spotted having two hitch holes.

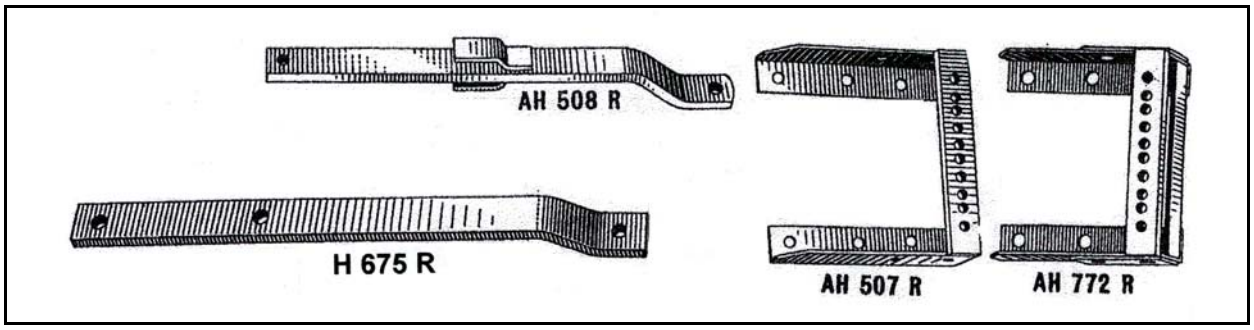

Figure 8-1. 1939 Drawbar Configurations

Cast Front Wheels -- The early front wheels were much weaker. There was no reinforcing boss around the five oval openings as found in the later versions. There is also some variation in the wheel weight mounting holes and bosses. This change doesn't affect interchangeability.

Figure 8-2 (A&B).

Figure 8-2. Two versions of AH570R flywheel. At left is the early flywheel installed on H-9053, 16-1/4 inches in diameter and 2-1/2 inches wide at the rim. Compare with flywheel at right installed on H-47511, 17-1/4 inches in diameter and 2-3/4 inches rim width. Note the pattern difference of threaded pulling holes in relation to expansion slots, left versus right.

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Flywheels -- Early flywheels were narrower and smaller in diameter, and the threaded puller holes were close to the expansion slots. When the flywheel changed, the part number did not because the later flywheels are direct replacements for the earlier ones. The threaded puller bolt holes were relocated to be at a right angle to the expansion slots for the new, larger flywheels. Found and believed to have been inserted into FSB 139 (11-15-42), is an undated, typewritten 2-page document over a "DEERE & WEBBER CO" signoff. It deals with angular flywheel position specifications of various timing benchmarks for Models A, B, G and H tractors. This "letter" also establishes H-9151 as the starting serial number for the bigger AH570R flywheel.

Brake Shoes -- We find longer brake shoes and facings up through about 7805. The facings (H434R) for the early tractors had a chord length of 8-3/4 inches, and both shoe and lining have a hole pattern different from the later tractors, and (of course) from available replacement parts. To mount new 8-inch-long facing (H679R), onto the early shoes, you must re-drill the early brake shoe to the new facing hole pattern. The assembly part number changed from AH1154R to AH1155R. (FSB 110-S, 6-15-40).

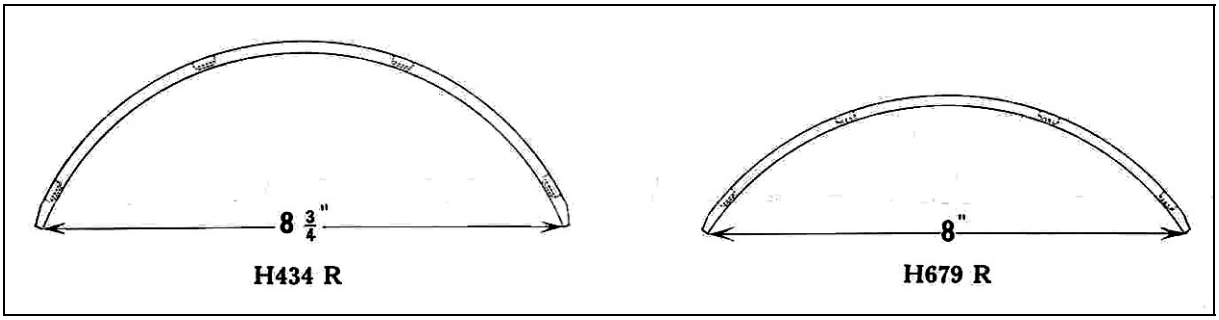

Figure 8-3. Early brake facings at left, redesigned facings on the right.

French and Hecht Steering Wheel -- For the early '39's, the steering wheel had a larger hub embossed with the manufacturer's name. The overall diameter remained unchanged -- this is just something interesting to look for.

Woven Mesh -- Earlier '39's had woven mesh over the air intake in the hood that later changed to a pressed mesh such as you find in most two-cylinder JD grille sections.

Narrow Rear Wheels -- The '39's were outfitted with the narrow, 6-inch wide rear rims (took 7-32 tires), and at this writing, it is believed the narrow rear rims were installed on most tractors below 10,000. Rims that were 7 and 8 inches wide were made available soon thereafter. Once the change was made, all of the later tractors have the 8-inch rims to accommodate 9-32 (now 9.5-32) tires. At this writing, there is no known source for new 7-32 or 8-32 tires to go with the 6-inch or 7-inch rims. Installing a 9-32 tire on a 6-inch rim takes only 2 inches from the balloon circumference and thus reduces mounted-inflated tire width by a scant 2/3 of an inch! Thus, there is little need for concern in mounting the current 9.5-32 tire on 6-inch (or 7-inch) rims. Further, if your tractor has narrow rims that are generally beyond economical repair, the logical choice is to opt for 8-inch replacements to go with the now-available 9.5-32 tires. One other subtle but interesting feature is that for the 39's, the wheel lug bolts were dome-shaped, not flat headed as most JD tractors are equipped with.

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Fan and Fan Shaft -- While not illustrated in PC304, there are a number of differences that will most likely make the 39 versions incompatible with later models. As a "for-instance," the 39's made no provision for a generator pulley. As a point in fact, the generator pulley variations continued beyond the 39 models.

Main Case Casting -- The H326R casting was not drilled for a starter mount, nor were later H700R main case castings until H27000. From 27000 and up, all main case castings were so drilled.

Platform Drilling -- The platform was not drilled for power shaft master shield, for lighting, nor for the H989R (safety) extension between operator and flywheel. Some were drilled for the master shield and for lighting, but not for the extension!

The 39-H Gear Shift Assembly

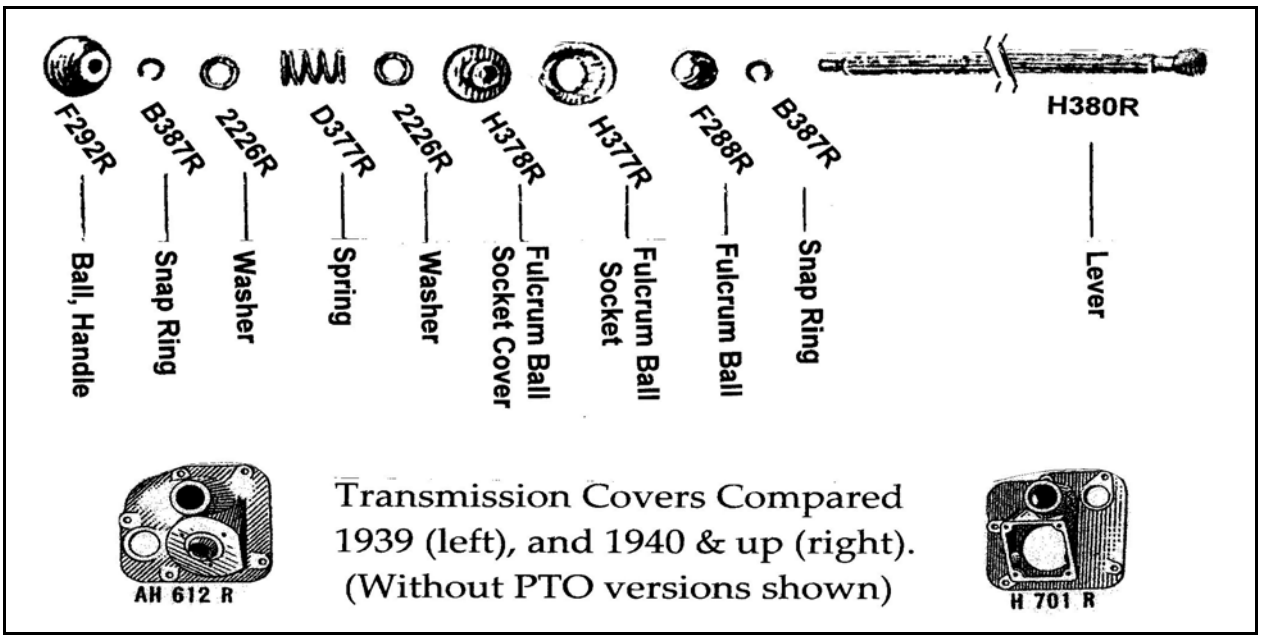

Figure 8-4. The 39-H Gear shift Assembly

Shown in figure 4-1 (at left - above) is the transmission cover with H377R fulcrum ball socket installed. This socket is a near-press-fit into the cover, making removal a bit of a challenge. To remove the gear shift assembly, remove the F292R ball handle (The handle unscrews from the gear shift lever), and remove the three small cap screws securing quadrant. Lift quadrant away. Reinstall the F292R ball handle to assist in removal of the gear shift assembly which is not easy, and is best done by means of penetrating fluids, moderate heat, and gentle tapping and prying around the outside of the fulcrum ball socket. One fellow told me, " The only way I got mine to move was reinstalling the ball handle, pulling with all my might and then taping with hammer on underside of ball handle. Once I got it out and cleaned then it goes in and out much easier."

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Trouble with the snap rings? This is not unusual. For the bottom, it is becoming customary to spot-weld a ring in place. The ring can be an old B387R snap ring, or a 5/8" lock washer with the bend taken out of it. For the top snap ring, a few choices exist. If you are real adept with a small Dremel™ type grinding disk, you might try enhancing the groove in the gear shift lever. There is the EC-62 External Clip solution as outlined in the basic text. One enterprising fellow proposed drilling at the groove so as to insert a cotter pin (tricky at best - and may weaken the gear shift lever at a critical point).

Once inspection and repairs are completed, reinstall by reversing disassembly steps above. Ensure the fulcrum ball, its socket and cover are well treated with bearing grease during build-up. Apply a coating of Permatex 2B™ (or equivalent) to the interface of the fulcrum ball socket and transmission cover. You will note that the three holes for mounting the quadrant are not symmetrical. The quadrant piece will fit only one way. In the unlikely event the quadrant base plate breaks away from the "top hat" part, observe the "up" orientation of the base plate BEFORE welding so that its "up" direction is coincident with the "up" direction of the "top hat".

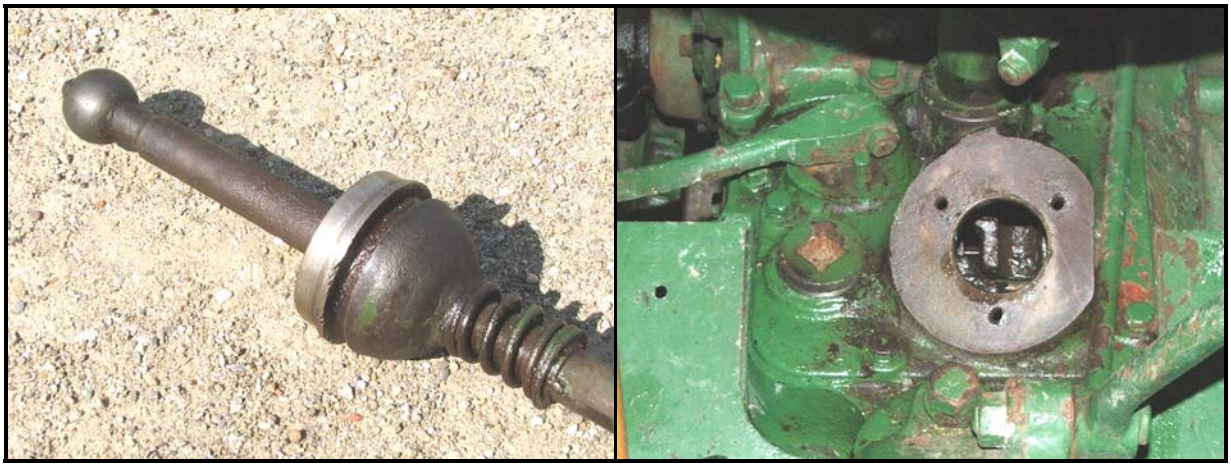

Figure 8-5 (A&B). 39-H Gear Shift Assembly (left) and Transmission Cover Port (right)

Part Change Without Part Number Change -- As in the case of H1013 at the Pavilion, you can pretty much depend on your Parts Catalog to identify JD "H" parts that will fit on your 1939 tractor, but you cannot depend on the part number to tell you what the part looked like on the 1939 showroom floor! For more discussion on this issue, see this same heading in Chapter 1.

Listing of P/N changes versus S/N breaks (See PC304 Parts Catalog for page and key) -- You will find a part number change when a change is made that changes "form, fit and/or function". And this is where your PC304 Parts Catalog comes in handy during procurement of replacement items. Deere & Co. always stressed model and serial numbers when ordering parts. Actual part number is always preferred.

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39-H Part Changes, the Biggies!

Section 1 -- Camshaft Redesign (1000 thru 9999)

Page-Key	Nomenclature and Part Number
2-4	Main Case S/A, AH671R (H326R)
8-16	Camshaft with nut AH559R
5-20 thru 5-26	LH Camshaft bearing & housing, AH887R + Hardware
(9-47 thru 9-51)	H247R & JD7696R + Hardware
10-9	Clutch driving disk
10-10 thru 10-12	2 snap rings and bearing, A378R, A1401R and JD7697R
10-16	Pulley w/bushing and pin, AH1103R (H330R)
11-31	Pulley gear w/key AH1180R
11-71	Clutch Operating Sleeve, AH1213R

Section 2 -- Shifter Redesign (1000 thru 9999)

Page-Key	Nomenclature and Part Number
23-8	Shifter quadrant, AH690R
23-10	Plug, NPT 15H281R
23-14	Transmission cover, AH612R (H375R)
23-15 & 28-7	Gasket, H376R
23-19	Shifter ball, F288R
23-21	Shifter lever, H380R
24-1	Set screw, 22H139R
24-10	Shaft, shift fork H382R
24-11	Shifter S/A, 2nd and 3rd gear, AH614R (H381R)
24-12	Yoke, H384R
24-15	Yoke, H383R or H818R
24-16	Oil collector, H385R
24-17	Shifter S/A. low and reverse gear, AH613R or AH907R
28-8	Cover, transmission AH713R (H608R)

Section 3 -- Sliding Gear Shaft Redesign (1000 thru 9999)

Page-Key	Nomenclature and Part Number
25-10	Sliding gear shaft, AH723R (1104 thru 3209)
	Sliding gear shaft, AH724R (3210 thru 9999)
28-16	Shifter w/yoke AH715R (H615R)
28-17	Yoke, H616R
28-20	Gear w/bushing, AH 1194R
28-21	Bushing, H594R
28-23	Cone w/rollers, JD7358R
28-26	Bearing cup, JD7250R
28-31	(Same as 25-10 above)

Appendix 9

John Deere H-42820, 9/5/03 Forward Journal page

Item #	Discrepancies	Remedial Actions
9.	Muffler & Exhaust pipe shot	* R/R AH519R Muffler, Shim w/2 washers right & one in center, grind left side tab some. * R/R H1059R Exhaust Pipe
10.	Excess play in steering, hard to turn	* R/R both JD7364R Worm Bearings
	* Noticed spindle movement! Eccentric bushing free to rotate back & forth! 19H98R Lock Screw head nearly gone, and the screw tap in pedestal casting is wallered out	* Redrill and install 5/16 helicoil, 1/2 inch deep * R/R 19H98R Lock Screw
	* Excessive end play in spindle, missing all but one shim!	* Replenish H198R shims, make proper . adjustment
	* Steering shaft worn at rear Brg * Rear bearing (H277R) also worn	* Build up & lathe back to 3/4" dia (machining) * Overbore, install bronze bushing & grease zerk
	* JD7698R thrust bearing apart! (10/13)	* R/R JD7698R bearing, and H546R cork washer, also install missing 24H72R retainer washer.
	* While working this area, found no packing there! ******* **See item # 40** *******	* Install new H199R cork packing, also B1564R packing.
11.	Carb -- fuel will not flow, caked w/rust inside & float is shot.	* Cleaned with boil out kit (Started 10/8/03) * R/R AR10067R Float * Install basic rebuild kit * Found lower fuel line stopped -- opened it up!
	* Found carb entry chewed up some * **Jan 13, 04** run up not successful ****** **See item # 41** ******	* R/R AR10035R inlet fitting/fuel screen * Engine loping -- fuel starvation apparent, flow is puny -- float adj not right (<u>service manual wrong!).</u>
12.	Magneto - Bad Distr. Cap, more!	* R/R Distr. Cap (Completed 10/8/03) * R/R Rotor, Points & Condenser (Completed. 10/8/03) --------Magneto spark test passed on 10/8/03-------
	Bad plug wires Sparkplugs contaminated Plug shields missing	* R/R Plug wires * R/R Spark plugs (and clean existing plugs) * Replace & install shields @ $55/pair
	*Mark @ No. 1 TDC	Magneto shaft like a "D" - flat part to the rear.

Appendix 10
To Paint a John Deere Model "H" Tractor

Assume the tractor needs NO SERVICING and NO WORK other than to be cleaned of mud, barnyard waste, field dirt, plus the usual oils and grease. Assume further that there is sufficient surface rust and that there are dings in the sheet metal to be dealt with.

The **overall strategy** is quite simple: clean to remove "cling-ons", brush and sand to remove surface rust and prepare for primers, disassemble to the extent required so as to reach all areas, apply various fixers and primers to both main tractor and piece parts, prepare all surfaces for paint, paint pieces (some of which are reinstalled prior to final paint and some of which are to be installed only after final paint), perform final assembly, and touch up as required. Sheet metal parts are treated on a separate track, taking them through disassembly, repairs and preparation, applying needed primers, and then final paint, followed by pre-assembly and decals; all before reinstallation on the tractor.

Requirements: Solvents, eye protection equipment, paper towels, narrow and wide putty knives, tool box of hand tools, hydraulic jack, 2x4 and 4x4 wood blocking pieces, wire brushes, side grinder with 6 inch twisted wire brush, 5-ton gear puller, bearing grease, primers, PB Blaster™, BONDO™, OSPHO™, and paint products. *See "Solvent Types" at end of this Appendix.*

Clean Step 1: Apply solvents and make a trip to the local hand-operated car wash. Take eye protection with you. All loose and semi-loose dirt, grime, oils and grease should go "down the drain." Remember to make cleaning of the tires part of the cleaning. As you leave the car wash, be a good neighbor by hosing all debris down into the drain. *A good idea here is to enclose the magneto in a plastic bag so you can start the tractor after the wash.*

Clean Step 2: Assuming some caked-on deposits of foreign materials remain on the tractor, spread a sheet of "throw-away" visquine under the tractor to catch scrapings. Then proceed to remove the bulk of what remains after the car wash. Wear eye protection. You will be on your back, under the tractor, looking up while debris will be falling down! Once the scraping is done, various solvents and paper towels are helpful in removing the last of the deposits. You won't necessarily be able to reach all areas on this pass. Some items will have to be removed from the tractor for cleaning. As this step wraps up, fold and roll the visquine into a small package for disposal.

Disassembly Step 1: Drain coolant from the radiator, and fuel from the gasoline and fuel tanks.

Disassembly Step 2: Remove the front medallion, steering wheel, steering worm shaft, and grilles. As parts are removed, accumulate all fasteners and small hardware items in a catch basin or small pail that is partially filled with mineral spirits to act as a mini-parts cleaner.

Fasteners: Plan to use a new set of sheet metal fasteners during final reassembly (See list at chapter 2 end). And for all other fasteners, make note of any which are no longer serviceable, procure replacements, and include them in with the accumulation to replace the defective ones.

Disassembly Step 3: In preparation for hood/tank S/A removal, disconnect and remove oil pressure gauge line, disconnect temperature probe from upper water pipe, remove spark plug covers, pull ignition wires from magneto and from spark plugs (leave wires in the conduit pipe), remove fuel line to the carburetor from 3-way cock, and remove two cap screws that hold rear tank bracket to the engine block. Remove the exhaust pipe and muffler to make removal of the hood/tank S/A easier.

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Once remaining hood screws are extracted, remove the hood/tank S/A. This is an excellent point in time to apply a penetrating agent such as PB Blaster™ to the remaining fasteners of the hood/tank S/A. Set grilles, medallion and hood/tank S/A aside as the sheet metal group to be dealt with separately. Once hood/tank S/A is removed, reinstall steering worm shaft and steering wheel (loosely) to enable you to move the tractor.

Disassembly Step 4: Continue removals to include the air cleaner, carburetor, air inlet elbow to the carburetor, magneto, air breather cover, radiator shutter S/A, pulley cover, pulley brake, and the drawbar. The drawbar comes off in three pieces plus fasteners. Closely inspect all removed hardware for serviceability. Look especially close at the drawbar pieces for cracks in weldments. Schedule repairs and plan work-arounds if needed.

Clean Step 3: Using solvents, various tools and toweling, perform final cleaning of areas not reachable before removing the parts above. Carefully use a wide, soft plastic tool (ex: BONDO applicator) to straighten fins of the radiator core. Use compressed air to clean dust and debris from the core.

Clean Step 4: Wheels and axles -- Work rears, one at a time. Jack a side up; remove the seven wheel studs and separate wheel from hub. Using hub clamp bolts, remove hub clamp from hub, and hub from axle (See Wheels in Chapter 6). Apply penetrating fluids several times on successive days in advance. Heat can prove helpful too. DO NOT beat on the hub with a hammer! Use a puller. Clean the splines of both hub and axle down to clean, shiny metal. Apply bearing grease to hub splines. A choice is now before you: to apply lubricant to the axle splines, or to paint. TY25797 Graphite Lubricant (aerosol can) holds great promise to treat axle splines, and is best IMHO. To paint, apply (sparingly) TY25631 Blitz Black or TY25657 Muffler Black paint from your JD Dealer. Allow plenty of cure time, then re-install hub and wheel, and release the jack. Perform similar operations on the front wheels, taking this opportunity to clean spindle areas not accessible beforehand. Set hubcaps aside for separate cleaning and painting.

Clean Step 5: For the parts removed in disassembly steps, ensure all are fully degreased and on shelves in temporary storage so-to-speak. Sheet metal and the gauges are addressed separately below.

Prep Step 1: Remember protective eye wear and chemical resistant gloves. Using all manner of wire brushing, sandpaper and volatile solvents such as mineral spirits and carburetor cleaner, begin to prep tractor and removed parts for primer. Work wheels separately. For the under belly portions of the tractor, the powered twisted wire brush does wonders, cutting thru light rust and old loose paint. Once surfaces are so dealt with, apply OSPHO to convert remaining rust to an inert, hardened phosphate. Before primer, OSPHO'd areas will be wire-brushed and/or sanded again to remove unconverted OSPHO. Clean fasteners with a wire brush mounted on a bench grinder.

Prep Step 2: Remember protective eye wear and respirator. Apply suitable primer paint to both tractor and removed parts that have been both cleaned and prepared in step 1 above. Ventilation in the work area is essential. Hanging removed parts on a line outside for a 'paint shoot' works very well. Include all fasteners (nuts and bolts). When doing smaller pieces, one at a time, quality aerosol primer paints are generally acceptable, and very handy! Your automotive supply store and/or your John Deere dealer will have quality aerosol primer paints. Temperature comes into play when working with paints. Painting at 75 Degrees F or higher is best, and below 70 degrees F is not recommended. When cured, perform light sanding operations to prepare primed surfaces to receive final paint coats.

Final Green Paint Shoot:

a. The tractor and all removed parts (See sheet metal separately) are now ready for application of final coats of paint. One should have a plan: be mentally prepared by study; knowing various ratios of paint, reducer and hardener, establishing a place (or places) for the shoot, setting the correct air pressure at the compressor (45 to 55 psi, nominal 50 psi for the old style spray guns), and having your in-line moisture collector close to the spray gun end of the line.

b. Make sure other valuables (like the family car) aren't in the region of over-spray, and if you plan to paint on the driveway, lay a large enough piece of visquine down to prevent ending up with a John Deere Green driveway! The removed parts are best painted while dangling from a line similar to a clothesline using hooks made from 9-gauge solid steel wire.

Figure 10 (A&B). A - Shifter leather seal is protected using tissue. B - Deflated rear tire masked using blue masking tape and newspaper

Don't forget to clean all fasteners (nuts and bolts) and paint them also. For convenience during final assembly, presort fasteners according to diameter.

c. Roll the tractor to the designated place of painting. Jack it up and remove the wheels, placing secure blocking under each rear axle and under the front (spindle) to support tractor. Also remove the steering wheel and steering worm shaft. Mask off the following areas: spark plugs, radiator core (both sides), radiator hoses, the air breather port on the tappet cover, governor's magneto flange (center part only), left and right brake adjust screws (optional), manifold (or at least its carburetor facing), the clutch parts (those normally under the cover), the axles, and the leather seal of the shifter quadrant (pack with tissue).

d. After sufficient cure time, reinstall wheels and steering parts. Roll tractor back into the shop or garage. Jack up and block tractor again. Remove the wheels for cleaning and painting.

Wheels and Tires, Front and Rear

a. Use a 6 or 9 inch side grinder equipped with 6 inch (or better) twisted wire brush to strip old paint and rust from the wheel. Clean the hubs in similar fashion. Supplement process with Aircraft brand paint stripper to help soften that really stubborn old paint. A small, simple, low-cost, portable sandblaster comes in handy on the hub "hard to reach" areas. Coat cleaned wheel with OSPHO or Rust Converter to metal to prevent surface re-oxidation; tire remains inflated during this process. Allow overnight for cure.

b. In preparing to apply primer and paint to wheels without dismounting tires, begin by deflating the tire, taking measures to ensure the valve stem doesn't slip inside of the rim. Use blue masking tape (2 inch wide is best) going around the rim on each side, and as you go, press the rubber back from the rim and ease tape under the rim a bit. Then stand the wheel up, and go around the tire taping newspaper or equivalent over the tire to achieve full cover. Sand metal (wheel) and/or polish using an electric drill with wire brush. Use sandpaper as warranted. Ensure all of the residual Rust Converter is removed. Wipe metal part of wheel down with tacky cloth and apply a primer coat in the usual fashion. After suitable cure time, sand and/or wire brush once again to prepare for final paint. Shoot final paint in suitable quantity of coats and allow at least a couple days cure time before removing masking materials.

c. Once satisfied with paint finish on the wheel, remove all masking materials and re-inflate tire. The final step is to apply (brush on) two coats of black tire paint. During this process, the rear wheel assembly is horizontal but not on the ground. Support wheel with three short wood pieces of either 2x4 or 4x4, or some other support that prevents the tire from touching the work surface. Cut a round piece of cardboard from a large box with diameter roughly the same as the rim to be laid over the wheel to prevent any brush splatter from reaching the previously painted metal. Cut out the center as required for the hub.

Parts Not Painted

Parts of the tractor that are not painted include masked-off items: spark plugs, radiator core, radiator hoses, and the axles. Also included are the magneto and ignition wires, fuel lines, fuel 3-way valve and fuel filter S/A, exhaust pipe and muffler, and brass carburetor parts. Of course, the steering wheel is painted off tractor, green part first then some days later, the grip section black. Clean all brass parts and fittings to achieve its original sparkle, and the aluminum and Bakelite parts of the magneto to a renewed finish.

Electrical -- Delco original parts carried thick high gloss black paint. Starter motors, however, usually ended up green as with most JD Top-mounted starters.

The Sheet Metal Series

Here we find the medallion, grilles, and hood/tank S/A. The hood/tank S/A consists of the instrument panel with gauges, the fuel tanks, and both tank brackets. Attached to the rear tank support is the spark plug wire conduit with wires, all one large subassembly, just lifted from the tractor.

Disassembly: Having applied a penetrating solvent such as PB Blaster™ or Kroil™ to the hood/tank S/A fasteners beforehand, remove the fasteners to extricate the fuel tanks, rear tank support w/wires and the instrument panel with instruments intact. Take a picture and/or make sketch of fuel line orientation. Then from the fuel tank S/A, remove fuel line and fuel filter. Reference the rear tank bracket; remove wires from the conduit, but not the conduit from the bracket. If you DO separate the conduit from the rear tank support, take a picture beforehand to define the relationship between the two. Alternately, see Figure 202 for this photograph! Continue to accumulate fasteners for cleaning, painting and reuse.

Remove and clean gauges, and flush fuel tank. I absolutely recommend a new set of sheet metal fasteners for final assembly. See list at end of Chapter 2. New sets are available from www.jdhpubs.com.

NOTE: Inspect gauges for serviceability, also fuel tanks for inside rust. Finding fault here with either the tanks or the instruments, this would be the time to perform routine maintenance actions to: (1) remove and replace defective gauges, and (2) perform fuel tank relining to keep rust out of the fuel system. See special notes on gauges in Chapter 2, and on vendor sources in Appendix 3.

Body Work and Primer: Evaluate work needed on sheet metal (S/M) pieces. Make temporary holding jigs or mock-ups as required that support the S/M item in place during work. Use both handheld and powered wire brushes plus sandpaper to remove as much rust and other "coatings" as possible. Low-powered sand blasting is helpful here too. Just take it easy on S/M. In areas needing straightening and/or BONDO™, perform the work and apply BONDO™ to bare metal only; then smooth and finish per accepted methods and practices. Use OSPHO both inside and out to arrest rust not reachable. Prepare all S/M parts for a good coat of epoxy two-part primer; then apply the primer coat. Here is a good point in the process to chase all captive nuts in S/M pieces using 5/16-18 tap; renew the nuts as required.

NOTE: If you find rust-through areas in the S/M, one method of restoring strength is to apply fiberglass resin with fabric on the underside, followed by normal body finishing on the outside.

Final Green Paint: Prepare S/M surfaces for final paint using varying grits of wet sand paper. For this application, wet sanding is best because there is less accumulation of removed grit on the sandpaper. As a result, sanding effect is more consistent across the piece, and scratching is less likely. Final prep sanding is done using 600 grit sandpaper. Plan to shoot S/M indoors with ventilation or at least under cover if at all possible, and where ambient temperature is 75 degrees F or warmer. Use a suitable respirator when painting with hardeners. Again, some sort of mockup or jig to hold the S/M pieces is desired. Allow sufficient cure time before handling. If shooting without hardener, cure time is much longer. Be especially aware of your handling needs prior to the shoot; have a plan!

Decals: Cure time prior to affixing decals depends on whether or not hardener was used, and on the type of decals being applied. Where hardener was used, allow one week. If hardener was not used, allow up to 30 days. Cure time varies with decal type chosen. Revisit Chapter 2 for full discussion on decals.

Painting Small Parts: Painting of the tank S/A, small parts, and fasteners related to the hood/tank S/A are to be dealt with in the same way as other parts removed from the tractor. The "clothesline" method works out well here for small parts.

Final Assembly of the Hood/tank S/A: See "Paint and Decals" in Chapter 2. A second time, chase all 5/16-18 captive nuts before starting. During build-up, this S/A will reincorporate the fuel tank S/A and its two brackets, fuel filler caps, fuel filter, 3-way fuel valve and line to small tank, plug wires back into the wire loom, gauges, shutter control knob, and shutter control rods. See important assembly notes in Chapter 2.

Full Tractor - Final Assembly

It is assumed that all of the off-tractor hardware has been cleaned, primed and painted final green (or yellow) as appropriate. Begin final assembly of the tractor by removing all masking tape and other masking materials. Plan to use anti-seize compound with all fasteners.

a. Round up and proceed with installation of the shutter S/A, drawbar S/A, air cleaner S/A, carburetor and its air intake elbow and hose w/clamps, magneto, pulley brake, and pulley cover.

b. Repack front wheel bearings and permanently install front wheels, and hub caps. Also set rear wheels at a desired point on axles and secure in place.

TIP: For the rear wheels, remember to insert waxed paper between the hub and hub clamp prior to draw-up, and after draw-up, trim excess wax paper. This prevents the two from 'new paint-bonding.'

TIP: Reference rear wheel hub bolts -- (1) use bench vise and adjustable wrench to take some of the coil out of the lock washers, and (2) apply JD Muffler Black to both lock washers and bolts.

Install a pair of 7/16 x 2 inch slotted screws (no head) or studs into the top of the engine block; also include one rubber pad and the two spacers associated with the rear tank bracket interface with the engine block.

c. Decals can be applied given that sufficient cure time has passed since shooting final green.

NOTE: There is a relationship to be observed between the hood/tank S/A, steering worm shaft, and the muffler. If you choose, during this step, to install the hood/tank S/A before the muffler, then be certain you install the muffler PRIOR to installing the steering worm shaft. Observe that installing the muffler after the hood is in place may not be an option on every JD "H" Tractor. It DOES work for hand start tractors with serial numbers 27,000 and up.

d. With the help of two others, lift the hood/tank S/A into position, using one of you to guide the rear tank bracket down onto the two 7/16 inch alignment screws. Free up and connect the H625R shutter control rod to the shutter before one fastener is set into the hood/tank. Also, dress the temperature gauge lead and the ignition wires into position. Now proceed with fasteners. But before tightening any fasteners dealing with the hood, install the grilles. Loosely install mounting fasteners connecting the grilles and hood, and the hood to AH650R hood bracket using alignment bars as required.

e. If the muffler isn't installed, install it now before the steering worm shaft. Install the steering worm shaft, its end bearing and cap, and then the medallion. Observe there should be a small pad or two small cushions between the medallion and hood. These can be made of either rubber or cork gasket material.

TIP: See O-Ring Tip for steering shaft in chapter 2.

NOTE: When installing the worm shaft end-bearing cap, be sure to employ the same gasket thickness as before, maintaining the shaft's end play adjustment. This is perhaps the very best time as any to check all three front-end adjustments, and correct as required before final installation of the medallion. See Chapter 5, Section 9, or your Service Guide, para's 5-9 through 5-12.

f. At this point, begin to draw up hood fasteners being very deliberate and careful not to allow the screwdriver to slip causing damage to the new (and still soft) paint. Watch carefully when drawing up the side bolts securing grilles to the radiator frame. If you begin to distort the grille, STOP and install shims to achieve the desired appearance. *You don't want a warp!*

TIP: If holes fail to line up when installing hood and grille fasteners, loosen the radiator mounting bolts and see if some minor radiator movement will improve alignment. Don't forget to re-tighten them!

g. Connect the fuel line between 3-way fuel valve and carburetor, connect the temperature gauge probe into the upper water pipe, and reinstall coolant. Check for leaks and correct as required.

h. Connect ignition wires to the magneto, and to spark plugs during installation of the spark plug covers.

j. You should now be ready to put fuel into the tanks, inspect for leaks, and correct as required. Once a pass is achieved here, you are ready for paint touch-up. And the job is finished!

Solvent Types

Water is the most universal solvent in the world. Water under high pressure is especially effective -- even more so if the water is hot. Read the instructions that come with your pressure washer before introducing hot water. A pressure cleaner will remove nearly everything in its path: dirt, debris, grease, grime, or paint.

A bucket of soap and a brush will do wonders to dissolve the dirt and hold it in suspension for rinsing. Common household **dishwashing detergent** is great since it generally has oil-dissolving additives that work nearly as well on oil residue found on engine parts as on dishes.

You may also try **engine degreaser**. The spray on type that has foaming action works quite well as the foam tends to adhere to vertical surfaces. Apply the cleaner, work in with a brush as needed, and then, after ten minutes or so, hose it off with a spray attachment. They are most effective if the parts being cleaned are warm or hot. You should take care, however, in hosing off at the end of the cleaning. It is never a good idea to shoot cold water on a hot casting. The nice thing about these cleaners is that they tend to be environmentally friendly. They do a fair job of removing grease and oils, and the item dries clean to the touch. Cost is about the only drawback. An aerosol can doesn't go very far.

O**ven cleaner** used in place of engine degreaser reportedly works well, and the price is right. Be careful, however, because it is also reported to take paint up off a concrete floor. So if you've spilled paint on your shop floor, perhaps this will help you!

Aerosol forms of **carburetor cleaner** come in handy around the shop for those little odd jobs where that extra cleansing touch is needed. This compound is especially good when doing the initial cleaning on many tractor parts. It is very effective for stubborn, hard to get at oils and grease. It will serve well as a remover for paints not yet fully cured, so be careful where you apply this stuff

I have found numerous uses for ordinary, widely available **mineral spirits**. It is low-cost and convenient. Use it with a parts brush for cleaning parts. A **parts cleaner solvent** available from petroleum retailers is another alternative. When finished, strain back into original container for reuse. Discard any unwanted solvent still in the original container at the local recycler.

Other more **volatile** solvents are also available. **Alcohol** and a wide range of reducers (thinners) used with acrylic coatings are in this category. I frequently use **Du Pont's Nason Ful-Base Medium reducer**. The application for these is more for final paint preparation. Small hard-to-see smudges of oil and grease manage to transfer to your already-cleaned and ready-to-paint pieces in the handling process. A quick wipe with this solvent followed up with a tacky cloth will make most surfaces ready for a paint shoot. The drawback when using more volatile solvents is the need for plenty of ventilation. Further, they are generally highly flammable, so ensure you have that extinguisher handy. ++++

Appendix 11

Add a PTO to a Non-PTO Tractor

What you will need to add a PTO to your tractor -- This section assumes no Power Shaft was ever installed on this tractor. You need to acquire all items except for those with reference numbers 11, 12, 13 and 17 of figure 11-2 below. CAUTION: Before you spend any money, remove the rear transmission cover and ensure the power shaft forward bearing boss (huge ring in Fig 11-1 below) is fully intact, in the main case. These are known to break away in cases where excessive loads have been applied.

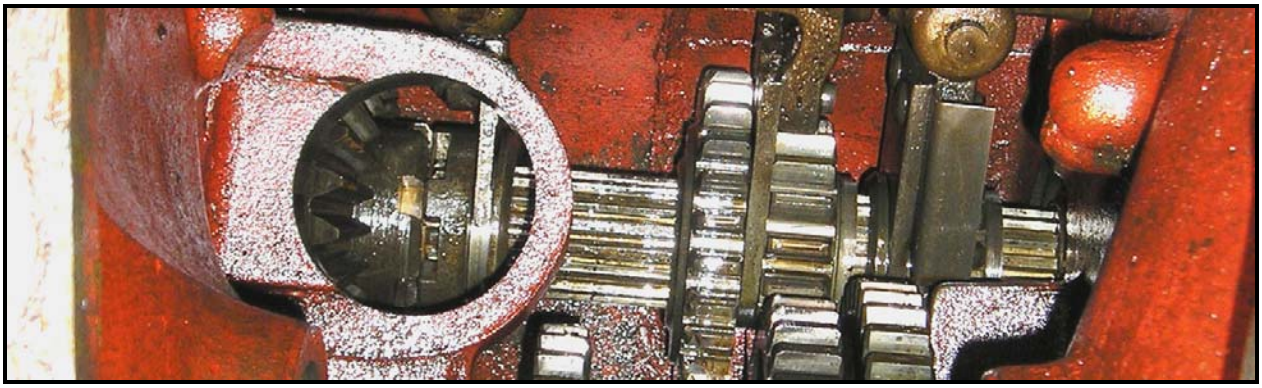

Figure 11-1. Looking into the transmission from the rear. PTO boss is on the left, a huge ring.

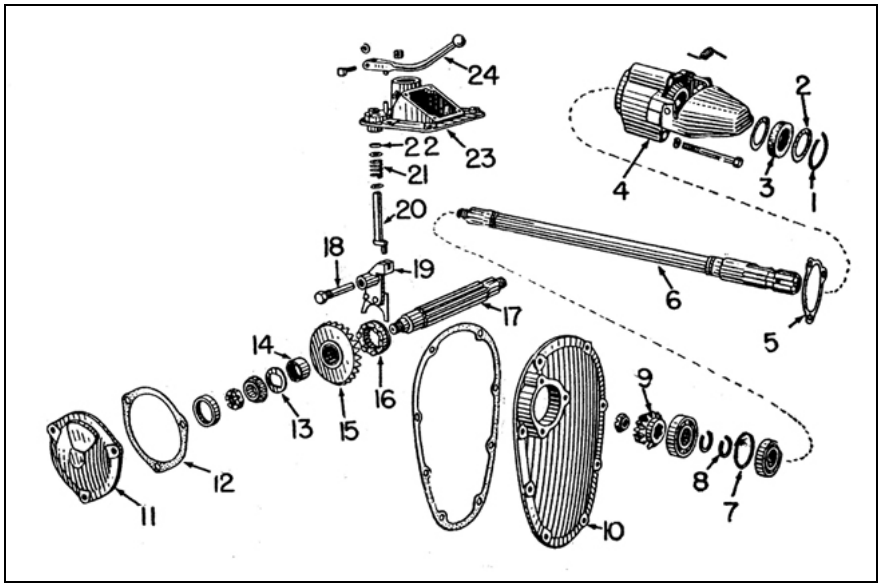

Figure 11-2. The JD "H" PTO System -- Illustration Only

The basic approach is to purchased (used) "collections" of the needed pieces versus bits and pieces that you will need. Buying the top transmission cover with its PTO shifter in place, and the rear transmission cover including the power shaft will be a big start. Be mindful of the various "inter-dependencies" such as PTO shaft diameter versus Master shield. Remain vigilant of serial-number sensitivities for top transmission cover, shifter and yoke, and the driving gear. For a small part of the tractor, many variations are involved. See pages 2 and 3 for guidance.

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PTO Kit for John Deere Model "H" Tractors

(Ref page 28 of PC304 Parts Catalog)

F/N	Part Number	Description	Effectivity/Commentary
1	---------	Bolt, machine, 3/8 x 1-1/2"	Part of # 4 below
2	A147R,	Key washer	Part of # 4 below
3	---------	Nut, 3/8-16	Part of # 4 below
4	AH925R,	Lever (H876R), shift	with H611R lock pin pressed in
7	H376R	Gasket	1000 - 9999
7	H720R	Gasket	10,000-up
8	AH713R	Cover Assembly	Casting H908R, 1000-9999
8	AH796R	Cover Assembly	Casting H702R, 10,000-up
9	H611R	Lock pin	Part of # 4 above
10	R1800R	Stop Pin, 3/8 x 1.5"	Dowel, part of # 8 above
11	H609R	Bushing	Part of # 8 above
12	H613R	Felt Washer	0.625 x 1.000 x 0.188" Felt
13	B2274R	Flat washer	0.688 x 1.125 x 0.060 Steel
14	A350R	Spring	
15	H612R	Crank	***Note # 1*** *Items 12, 13 & 14 are used along with Item 15, and if the crank is still installed in the used cover assembly, you're OK*
16	AH715R	Shifter with H616R Yoke	1000 - 9999
16	AH794R	Shifter with H728R Yoke	10,0000 - up
17	H616R	Yoke	1000-9999, part of item 16 above
17	H728R	Yoke	10,000-up, part of item # 16 above
18	H724R	Shifter shaft	(Usually bent! Should be ok)
19	Rivets	(to join Item 17 to 16)	part of # 16 above
20	AH1194R	Driving gear, sliding shaft	1000 - 9999
20	AH1195R	Driving gear, sliding shaft	10,000 - 17634
20	AH1196R	Driving gear, sliding shaft	17635 - up
21	H594R	Bushing, driving gear	1000 - 9999, part of # 20
21	H726R	Bushing, driving gear	10,000 - 17634, part of # 20
21	H791R	Bushing, driving gear	17635 - up, part of # 20
22 through 31		*Use original parts from non-PTO tractor.*	
32	AH1224R	Collar, sliding gear shaft	1000 - 17634

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F/N	Part Number	Description	Effectivity/Commentary
32	H798R	Collar, sliding gear shaft	17365 - up
33	H328R	Gasket, rear tranny cover	
34	H599R	Cover, rear tranny	
35	---------	Cap Screw (3/8 x 1-1/4"	8 used

Narrative Guidance

Be sure to pay close attention to s/n effectivity and power shaft diameter - critical!

Items 36 down thru 63 all deal with the power shaft and those items that will eventually go with it. The remaining guidance, therefore will be in narrative form, based on experience and what we read.

Items 57 thru 63 -- These are special and a very limited combination. Rare is the word! And if you have a power shaft with this bearing housing for sale, it would be wise to inform the buyer that the only shield that will fit this bearing housing is the H607R can type guard. H607R can type guards typically sell for $100 or more!

Items 40 and 43 -- The issues that drive items 40 and 43 were a result of Deere decision to comply with ASAE standards dealing with power shaft-driven equipment, specifically, with the relationship between drawbar and PTO shaft locations. In this day age, these data points mean virtually nothing, and can be ignored.

Item 55 -- The flipper guard can be used with most any combination except where items 57 thru 63 (above) are used.

Item 45 and 49 -- Item # 45 is of most interest, and drives the choice for item # 50. This housing depends on power shaft diameter; AH819R (casting H752R) for smaller shaft with diameter of 1-1/8"; and will be AH1097R (casting H1032R) for the regular shaft with diameter of 1-3/8". The housing are radically different in appearance with the one for the larger shaft much bigger, longer bolts are needed to mount the housing to the H599R rear cover.

Item 50, The Master Shield -- whereas the master shield mounts as an add-on over the power shaft rear bearing housing (a variable) and to the platform (position is fixed), the specific master shield to be supplied is dependent on the PTO shaft diameter! ++++

Appendix 12, Page 1 of 3

Rear Wheel Removal

Introduction -- For many owners, removing a rear wheel is a major challenge. The first action to take to separate nearly any pair of steel items joined by extreme oxidation (rust) is liberal application, over a span of several days, of a penetrating solvent such as PB Blaster or Kroil from the Kano Group (www.kanolabs.com). PB Blaster is readily available at most Wal-Mart stores. Screw pullers that one can rent on a day-basis often come up short here because there is little to grab -- plus damage to the end of the axle is highly likely. Use of some form of hydraulic power usually comes into play. The challenge is to design and build some type of fixture for a suitable hydraulic jack, but do this in a way that is not likely to come apart in your face while you are down close operating the jack! If wheels are mounted outside the hubs, it is helpful to pull the wheel studs and remove the tire and dish assembly away to storage.

Safety Tooling -- It is assumed at this point that the front of the tractor is supported at a single point with front wheel(s) or blocking. Neither condition will provide any stabilization to prevent tip over. This

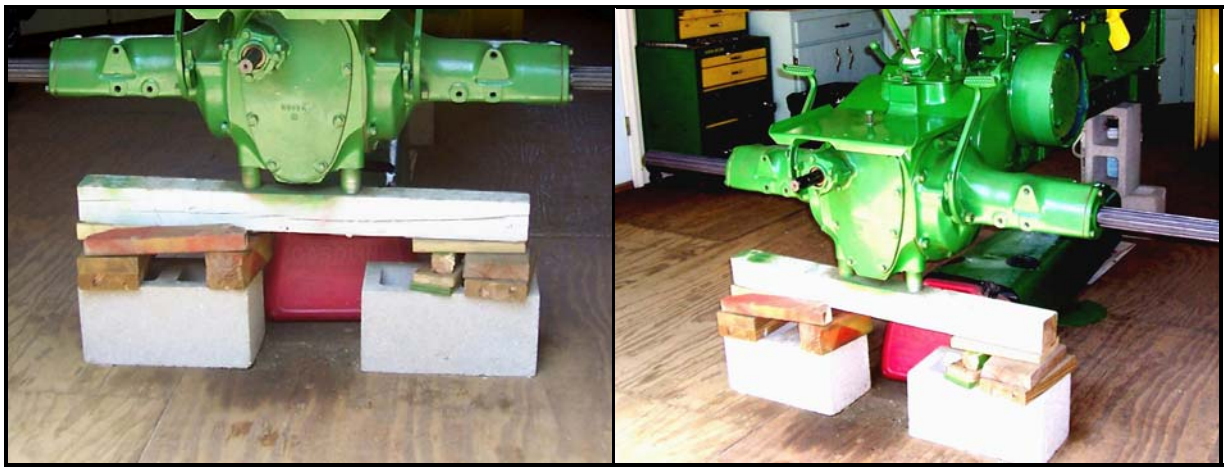

Figure 12-1 (A&B). A - Cross beam installed with shims, and B - Right side firmly perched.

is the driver for installing a cross support beam, made of 4x4 wood stock (or suitable equivalent), as instructed in Chapter 4. The length should be not less than four feet so as to provide a three-point stance that will prevent tip-over of the tractor once the rear wheels are removed. If you can tolerate a long piece in your work area, all the better. Figure 12-1 illustrates design, installation and use of the kind of blocking recommended.

This author used two Hex Head Cap Screws, 5/8-11 x 7" plus 5/8" flat washers (36 of them) all from Home Depot to secure the 4x4 beam to the main case. On each side, I had 17 washers between beam and main case, and one between bolt head and beam.

Wheel Hub Tooling -- The basic concept is to apply hydraulic pressure against the axle's end to pull the hub. Begin with an 8 inch square piece of 1/2 inch thick steel as a base plate. Bore three holes 11/16 inch in diameter, in a circle, 120 degrees apart, 2-1/2 inches from center to match of clamp bolting pattern in the hub. OR - you can use a hub clamp (turned around) provided that one is available. Purchase three 36-inch sections of 5/8 inch diameter, coarse thread ASTM A193 Grade B7 threaded rod plus a half-dozen grade 5 (2H) hex nuts from a fastener store like McMaster-Carr, or Fastenal, Inc. The required length is 30 inches here, but 24 inches may be too short!

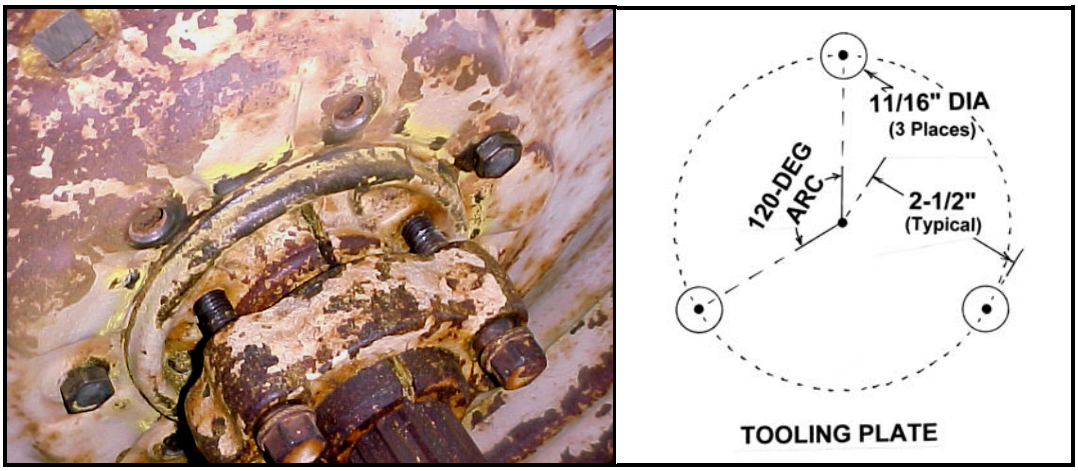

Figure 12-2 (A&B). A - Here is a typical find, Hub and Axle Rust-Bound. B - 8-inch Square Tooling Plate to be used with hydraulic jack to pull hub off the axle.

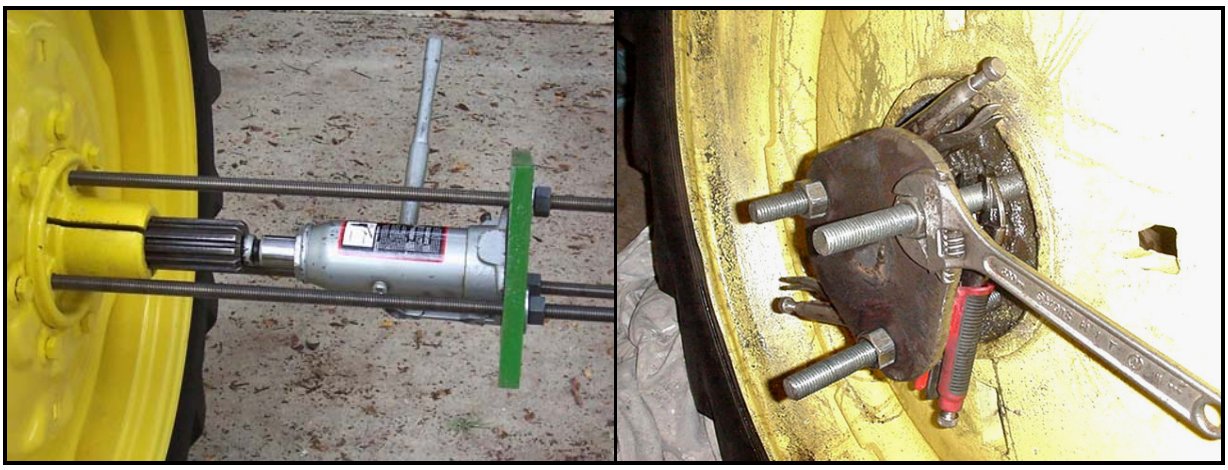

Figure 12-3 (A&B). B7 threaded rods, jack and three-hole tooling plated installed. NOTE: That the base of your jack is small enough to fit. At right, alternative is to use threaded rod and plate only!

In order to screw one 5/8 inch Grade B7 threaded rod well into each threaded hole in the hub, start by putting a pair of nuts on the one end and locking them together. This is equivalent to having a head on this long treaded rod! Then use the outer locked nut to drive the rod into the hub's threaded hole. Some lube is a great idea here! Don't be satisfied with going in a few threads. Screw threaded rod full through to the far side of the hub.

Then all three rods are in place, remove the nut-pairs of nuts, slip the base plate (or hub clamp) onto the three rods, and reinstall a nut with washer on each rod. Turn nuts clockwise (CW) to adjust the distance between the base plate and axle's end to your jack in its "collapsed position." You must position your jack with its operating piston DOWN. And when satisfied you have a square setting of the jack against both the axle and base plate, snug the three pairs of nuts up on each rod. From this point you apply pressure by sequentially going round and round, a little at a time.

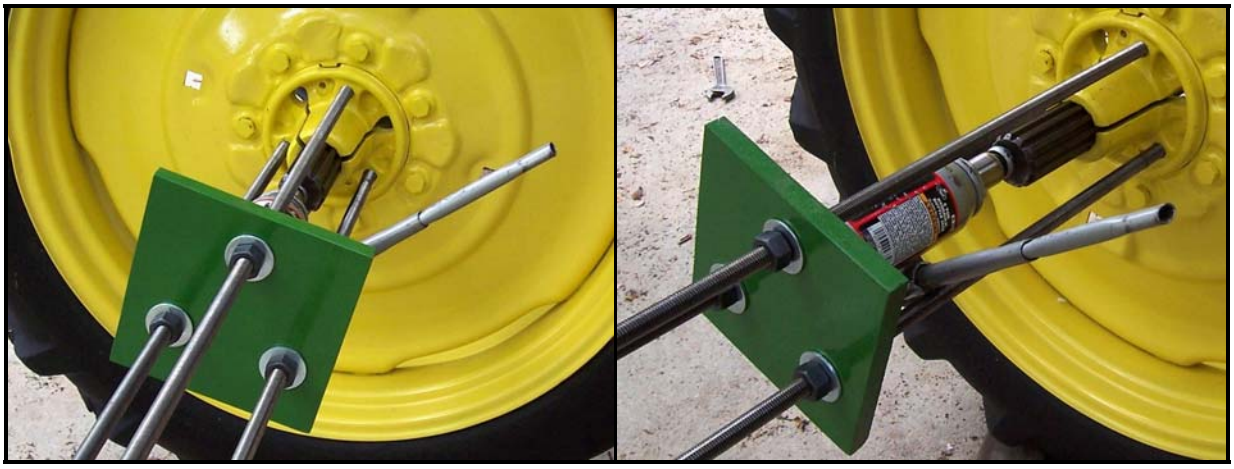

Figure 12-4 (A&B). Alternate views of jack installed with tooling plate detailed in Figure 12-2B.

Figure 12-5 (A&B).

Figure 12-5. Two views showing a hub clamp being used in place of the tooling plate. Here the "almost too large" base of the jack comes in handy! The only condition here is that at least one hub clamp be accessible for pulling use. If the rear wheels are set such that both clamps INSIDE their respective hubs, and there is no other John Deere Model "H" Tractor nearby from which we could borrow a hub clamp, then the tooling plate will be needed.

Figures 12-3 and 12-4 shows a combination of tools, some special-made, to enable removal of stubborn, rusted-to-the-axle wheel hubs. Use of 5/8-inch coarse threaded rod (Grade B7) with Grade 5+ tensile strength, a 6-ton jack, and a steel plate drilled to match hole pattern in hub clamp. The base of this jack was almost too large to fit within the confines of the threaded rod pattern for the tractor. A larger jack would not work! In all cases, the pumping cylinder of the hydraulic jack is at the bottom. I must be!

If your hydraulic jack has a base that is too large, or if you do not have one, an alternative is a hydraulic jacking system known among many as the "Porta-Power" hydraulic tool. With such a tool, the hydraulic RAM is separate from the hand-operated pump. You may be able to rent a Porta-Power tool to use in lieu of a hydraulic jack. Check with the rental store so you are aware of your other tooling needs beforehand -- such as the three-hole tooling plate, or a buffer (flat) plate to use with a hub clamp.

Foothills Antique Tractor and Engine Club

TECH TIPS

POLARIZING YOUR GENERATOR

Did you know that your generator can deliver current for either a positive or a negative ground system? Well, it can. And you can make it work in either mode. But, if yours produces current with the wrong polarity, you might have to make costly repairs.

A generator produces current by passing conductors (the armature windings) through a magnetic field. The magnetic field is produced by electromagnets that surround the armature. Basically, the field portion of your generator consists of copper windings around iron core, often referred to as the pole shoes.

The voltage and current delivered by your generator is determined by the strength of the magnetic field and the speed at which the generator is running. But, the polarity of the current is determined by the polarity of the pole shoes, or the direction of the magnetic flux or field, which is determined by the direction of current through the field windings.

OK, so you install a generator and take great care to connect the wires properly so you won't burn out your ammeter or cutout relay. What could go wrong if the wires are hooked up right?

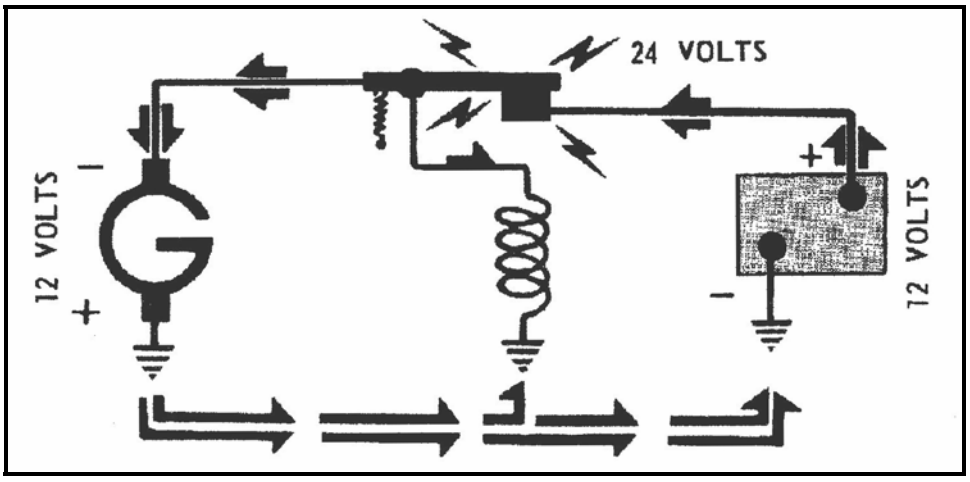

Figure 13-1

Plenty! When you start your engine, the generator will start delivering current. Since the generator is still isolated from the electrical system by the voltage regulator or cutout relay at this point, it will start producing current based on the polarity of the pole shoes. As soon as it begins producing current, some of that current will be directed to the field windings to strengthen the magnetic flux.

Appendix 13, page 2 of 2

According to John Deere's *Fundamentals of Service* manual, if the generator polarity is reversed, the generator will build up voltage and close the cutout relay points. This put the generator in series with the battery, and their voltages are added together. This high voltage across the points (about twice the battery voltage) can cause high current and enough heat to weld the points together.

This damage does not happen immediately. The instant the points close, the voltage is about the same on both sides of the relay coil, so very little current flows, and spring tension reopens the points. But, generator voltage will again close the points, and the cycle will repeat at a rapid rate. Heat and arcing will finally weld the points together.

When the points weld, the battery and generator are connected at all times. The low resistance of the generator allows the battery to continue to discharge through the generator. The high current can create enough heat to burn the armature.

How do you control the polarity of the pole shoes? The polarity is determined by the direction of the last current through the field windings. Since even a very small current can polarize the shoes, never assume the generator is properly polarized. *You must polarize the generator every time it is disconnected or serviced.*

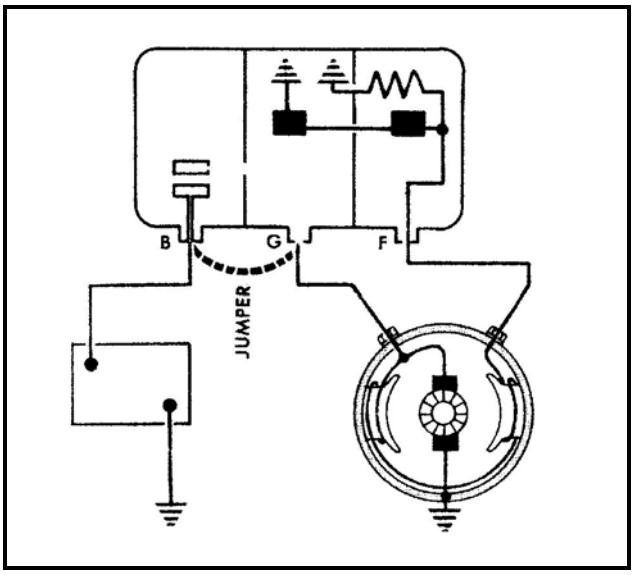

Figure 13-2

To polarize the generator, simply make a short jumper wire to short between the **battery** (b or **bat) and generator** (g or **gen)** lugs on the cutout relay or voltage regulator. Only a split-second or a spark is required, so simply tap your jumper wire onto the lugs and pull them right back off.

Reference: John Deere Fundamentals of Service (FOS): Electrical Systems, Fifth Edition. 1984. Chapter 4, Charging Systems. John Deere Service Training, Dept F, John Deere Road, Moline, IL 61265

http://web.utk.edu/~tprather/FoothillsTractorClub/TechTips/PolarizeGenerator.html

Engine Lubrication System

Oil is forced under pressure through the oil filter by a pump. Filtered oil is then forced through oil lines to the main bearings, and through drilled leads in the crankshaft to connecting rod bearings. The overflow of oil, which is forced out around connecting rod bearings, is caught by the revolving crankshaft and thrown to cylinder walls, bathing governor gears, camshaft, and other parts in the crankcase in oil. Oil is pumped to the tappet case to lubricate and cool valve stems, rocker arms and tappets. And an oil pressure gauge providing the real time reading is in plain view for the operator (from the John Deere Model "H" Restoration Guide, Chapter 3).

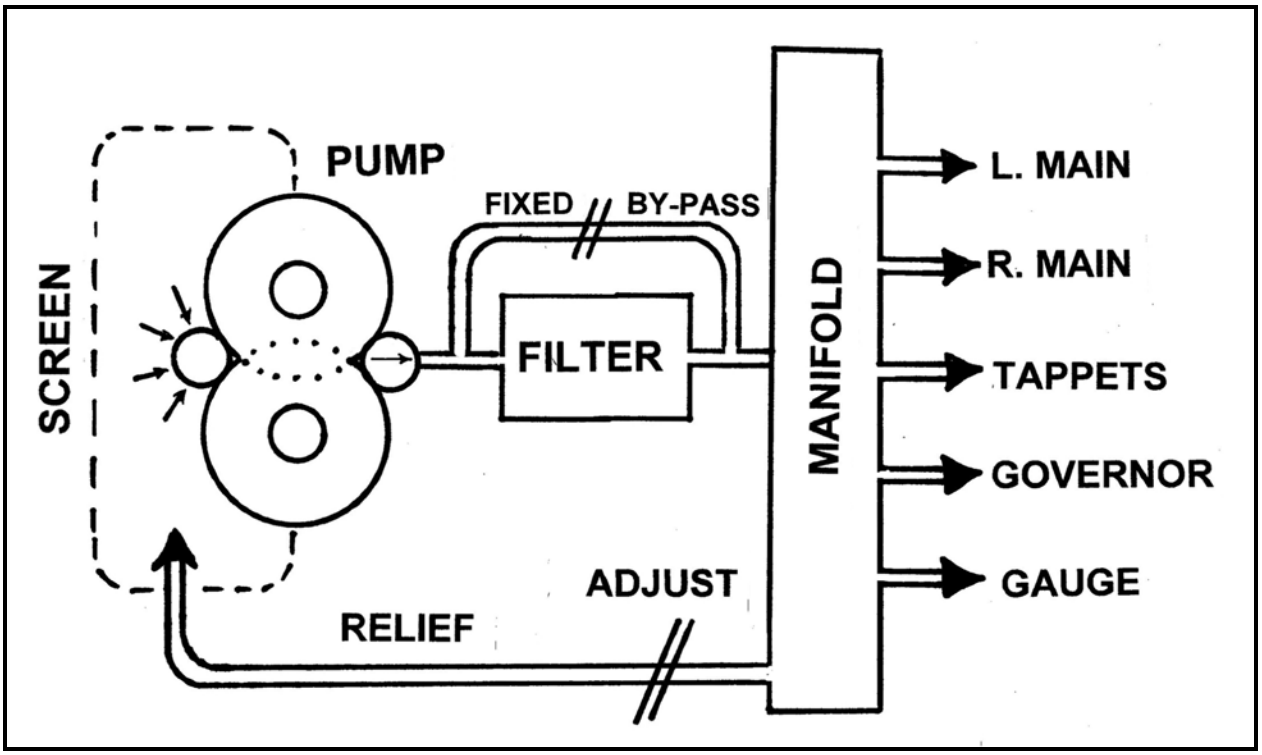

Figure 14-1, Schematic Diagram of Engine Oiling

John Deere two-cylinder tractors will employ a system similar to the schematic. The pump consists of a gear pair that simply and positively "grabs oil" in the gear teeth traveling around the perimeter of the gears and forces that oil through the filter and on to various destinations. Above we have the Model "H" schematic, others will be similar in principle, differing in design (leaf springs, spring-loaded plungers, etc.). Oil pressure is user-adjustable, the adjustment method varies among models, but the concept is the same. Without regulation, the amount of oil being pumped will vary with temperature and oil viscosity. At initial start-up when more oil is being pumped, excess oil is returned to the pump inlet section (Relief). This regulating scheme is a function of a relief spring held against a port of the manifold (Adjustment) under tension of another spring and adjustment screw. The end result is to be an oil pressure reading within a well-defined range of from 10 to 15 PSI (between M and H on the gauge). The pump is situated at the bottom of the crankcase. Oil drawn into the pump is screened, and oil pumped out to distant points of the engine returns to the crankcase. Note also an avenue for oil to bypass the filter. There is found another spring-tensioned gate, a "safety" in event the oil filter becomes totally blocked – allowing unfiltered oil to be pumped throughout the engine.

Figure 14-2 is a peek down into a JD-H crankcase, oil pump & pipes installed, but no crankshaft. Take note of the oil filter body and oil filter body head – nice and square in appearance.

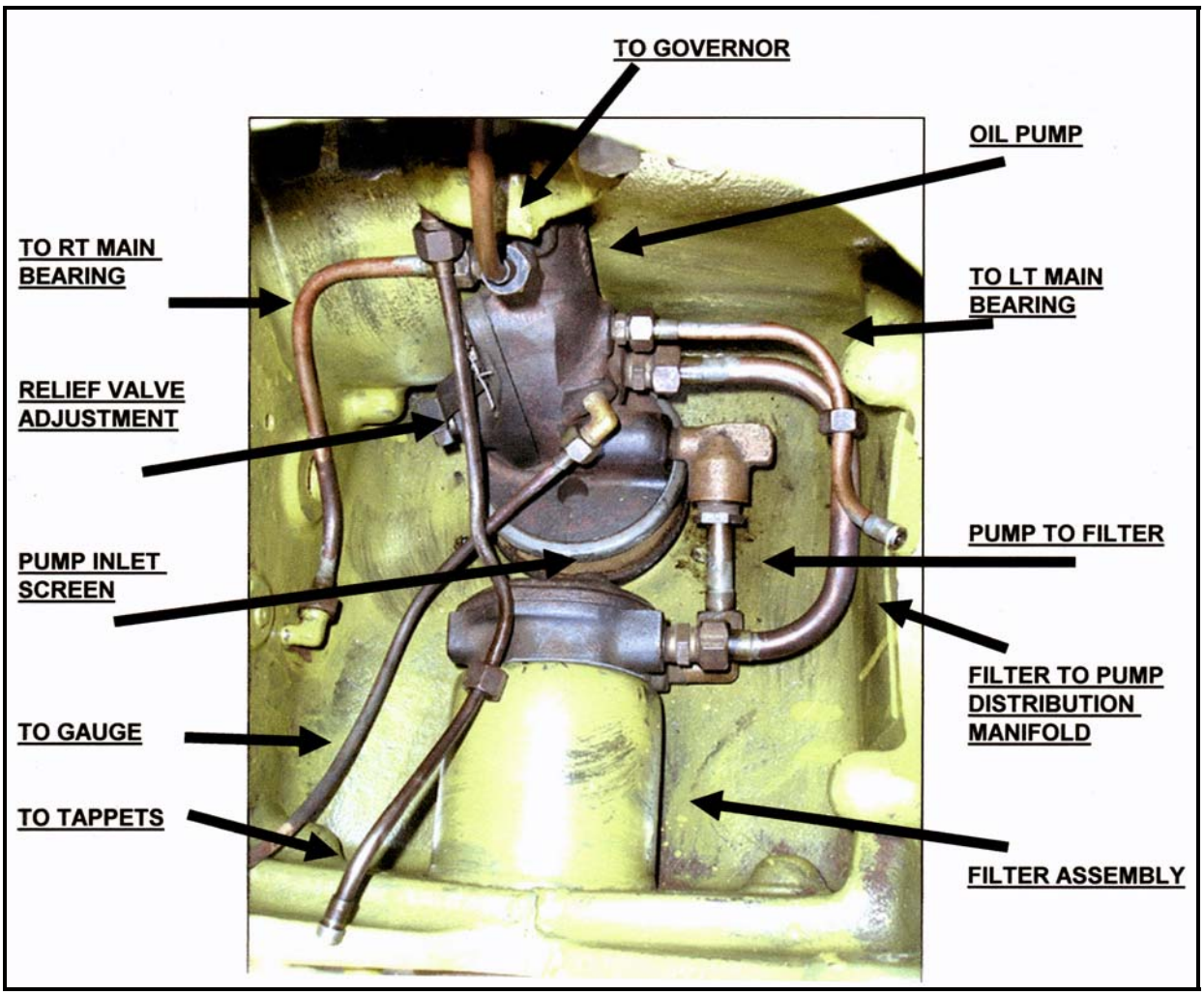

Figure 14-2. Oil Pump with Pipes

Pressure Regulation – Figure 14-3A illustrates the regulating part of the engine lubricating system. The adjust screw, when turned INWARD (CW) will exert pressure on the thin-looking relief spring by means of (unseen) a small coil spring – to increase oil pressure. The relief spring is pressed up against the sixth port of the manifold. Only when pressure exceeds a preset amount will the relief spring be pushed back to allow Relief oil (Fig 14-1) to return to the pump's input side.

For nearly all two-cylinder John Deere tractors, the oil pressure specification of from 10 to 15 PSI (between M & H) – this regardless of engine temperature or speed; even at slow idle! At least 10 PSI to ensure oil reaches intended destinations. And oil pressure shouldn't exceed 15 PSI because where pressure is too high, excessive amounts of oil are pumped, and this "excess oil" can cause an engine to use oil – the rings cannot scrape the excess oil away fast enough!

Figure 14-3 (A&B). John Deere "H" Oil Pressure Regulator Unit (left), and on the right is the "Author's Choice" of oil for Two-Cylinders Tractors

Engine Oil – Many ask what oil is best suited for the John Deere Model "H" and similar vintage two-cylinder tractors. At this writing, Figure 14-3B represents the "author's choice" once the "break-in" period is concluded.

Pressure Regulation -- The Details -- In Figures 14-4 (A&B), you see illustrated the detail of the relief spring, of the small pilot or "pip" as some tend to call it, the coil spring and also the adjustment screw. For some models, this adjustment can be accessed from outside the main case – usually by removal of a pipe plug. For some models, this adjustment is accessible only by removing the crankcase cover. In any case, instructions will generally tell one to stop the engine before making any such adjustment. You should consult your tractor's service manual before adjusting.

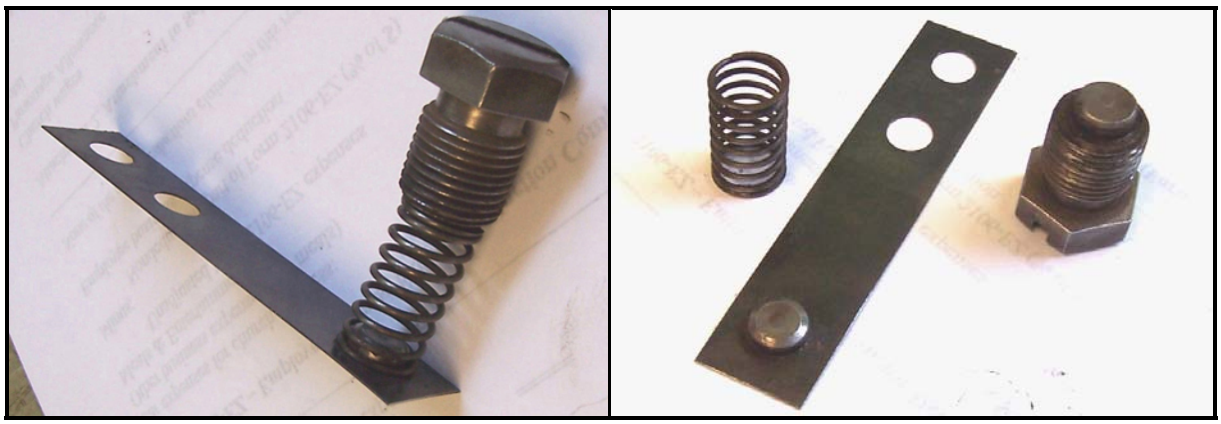

Fig 14-4 (A&B), Relief Spring Set; flat relief spring with pilot, coil spring and adjustment screw

A System of Interacting Pressures -- Looking back at the schematic on page 1 for a moment, many factors come into play when setting oil pressure. Each of the manifold outputs is designed for certain volume, and the individual calculated circuit resistances come into play to determine overall resistance to oil flow. This is much like having four or five hoses connected to one hose bib on the side of the house – if one bursts, all will lose pressure. If one is plugged up, the pressure increases for the rest. This system is much the same. So if an output is clogged, like the governor line on a "B" tractor for instance, pressure will rise. If your tractor has worn out main bearings allowing much of the oil to slide back into the crankcase prematurely, pressure will be lower. The bottom line here is that any rather sudden rise or fall in oil pressure should be taken as a signal that your engine's oiling system needs attention.

If You Have No History with The Tractor – A high or a low oil pressure reading will not tell you much. In this case, you must methodically test each engine oiling section to determine the cause for the "out-of-spec" reading, and take remedial action in order to protect the engine.

Fixed By-Pass for the Oil Filter -- As visualized in figure 14-1, and briefly stated in the paragraph below figure 14-1, The oil filter head contains a "spring-tensioned gate" relief valve. Figure 14-5A illustrates the spring contained in the cap section. In figure 14-5B, we see the leaf spring with its pilot; the valve port being just below the pilot. This valve operates under a fixed tension, and is designed to permit the system to continue to oil the engine long after the oil filter has become clogged. When this happens, of course, unfiltered oil is lubricating the engine.

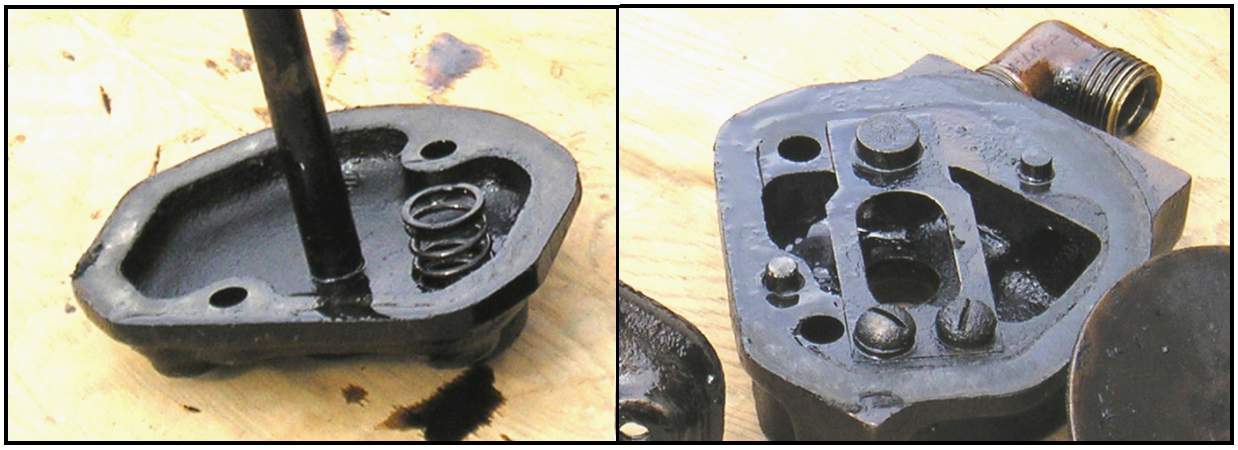

Figure 14-5 (A&B). Oil Filter Head, spring on left, relief spring & valve on right

Crushed Filter Body – Figure 14-6 -- Note the cave-in of the canister at the canister/filter head interface. This distortion, the drawing of the filter head too tightly into the filter body, was the result of applying excessive torque to the oil filter cap screw. Why? Men will apply added torque in attempts to stop oil leaking around the cap. The issue, however, is usually a hardened A519R filter cover gasket.

This tractor lost all oil pressure – because pumped oil escaped back into the crankcase without reaching the manifold, leaking out between filter body and filter head! The one single remedy is to renew the oil filter body (the canister); no easy task and special tooling is required! Consult your tractor's Service Manual. The lesson to be learned here is to renew the A519R oil filter cover gasket at least once per season. The most sound practice would be to renew this gasket with each oil filter change.

Fig 14-6. This oil filter body was removed from H-47511.

Finally, a peek down into the crankcase with the crankshaft installed reveals very limited access to the oil pump and its lines with only the C/C cover removed. The lesson here is to remove, and clean/overhaul both the oil pump and filter head assemblies when the crankcase is empty.

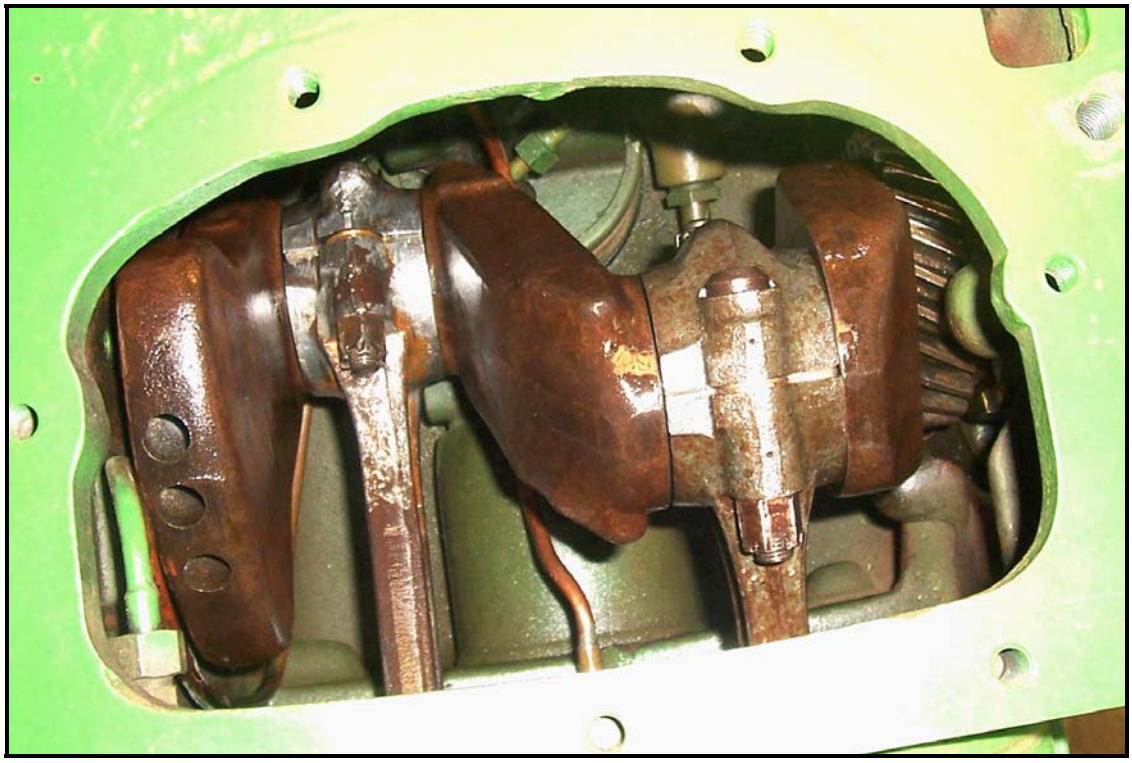

Fig. 14-7. Crankcase cover removed

Stories and Tales – I close with this section with words from others. From the annals of data I have viewed, I tell what others and I have found, or have heard of relating to either **low oil pressure** or **none at all** for Model "H" tractors. The format below is a Trouble-Shooting Guide. Some are from "victims of the experimentation of others"; before they realized they were victims! In your travels, continue to be aware that six or seven decades have passed since your tractor was built. This leaves it subject to the wiles of many so-called "brave" folks more than willing to tear into one of these gems with nothing to guide them. I caution that if one is spending the usual thousands dollars for a tractor, another $50 or $100 in manuals is a small price to pay for guidance!

1. Defective Oil Pressure Gauge. Check the gauge. If defective, replace it!

2. Sludge-filled Oil Pressure Sense Line. Disassemble and clean!

3. Improper Oil Regulator Adjustment. If no marked improvement is noted after adjustment, consider:

4. Sludged Oil Pump Intake Screen. Disassemble and clean!

5. Defective Relief Spring – One finding; the pilot (item # 39, PC304, page 3) became unattached to the relief spring (# 38) and was laying beside the H312R spring. This is equivalent to having a by-pass.

6. Wrong Pump Gasket -- New pump gasket (item # 28, PC304, page 3) was homemade – too thick – allowing "free" flow of oil within the pump. Oil "slips around" the pump gears.

7. Worn Pump – Inspect the idler and drive gear, the oil pump cover, and oil pump body for wear.

8. Damage Filter Can and Body Gasket – Inspect the top of filter head for damage caused by tightening nut on filter cover too tight. Pressure is lost due to leakage between the oil filter head and oil filter body.

9. Loose or Broken Oil Pipe -- One of the oil pipe fittings was loose; the nut had completely backed off and slid to the other end of the line. Once reconnected and tightened, pressure was restored.

10. Other Comments -- from the Gallery include the following:

10a. The rod-to-crankpin clearance was about 0.010 instead of the specified 0.001 – 0.003. And on this same tractor, the left-side main bearing found with 0.010 clearance instead of the specified 0.002 - .0004.

10b. I drained the crankcase and found an abundant amount of small seeds, somehow carried into the crankcase by some animal, blocking the pump's intake screen.

11. One hypothesizes -- the causes for poor oil pressure include a distorted or broken relief spring (38), missing pilot (39), or a broken spring (40). (See item numbers for PC304, page 3). A final such event would be that the adjust screw was backed all the way out and has fallen from position so that it cannot be restarted from outside the case.

12. One person tended to suggest -- that the John Deere "H" oil pressure-regulating screw may be adjusted while the engine is running. I rather imagine that fellow would be in for a shock as he stuck his long flat bladed screwdriver in only to have the crankshaft mangle the stuffing out of it! ++++

Appendix 15
Pan Seats

C1785 and D1796 Seats – The early unstyled (US) tractors (D and GP) carried first the C1785 pan seat, and then later on the D1796 seat – both having a pressed steel structure similar to the AD1606R. All three seats are interchangeable, however, the seat bolt may be peculiar to the seat part number. Both of the two earlier seats contained 24 holes arranged in two rows, with 13 holes in the upper row and 11 holes in the lower.

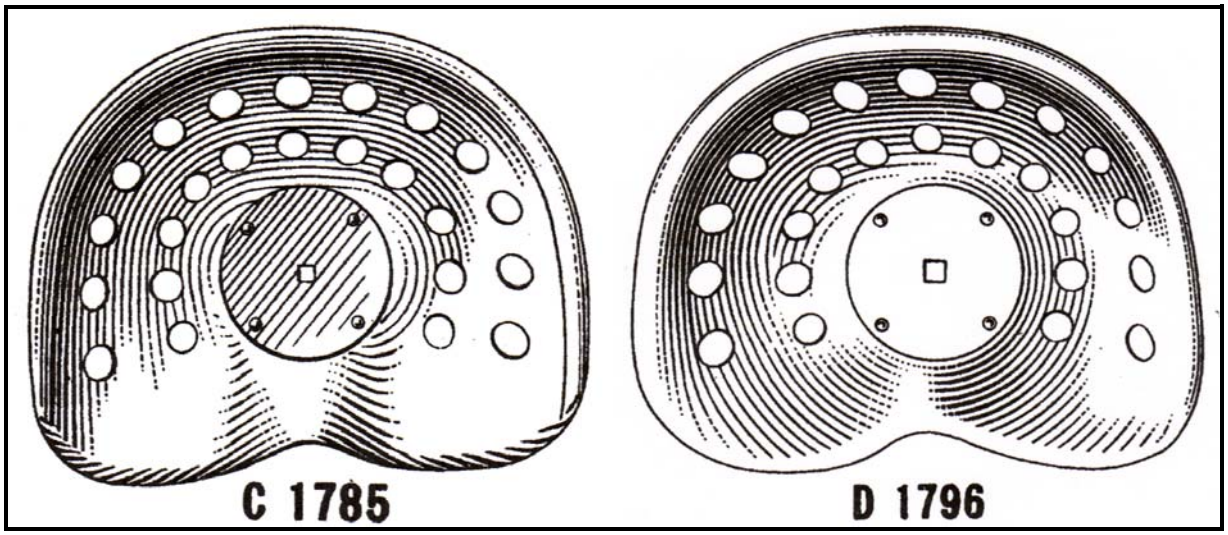

Figure 15-1

For the "D" tractors, we have C1785 seat from the beginning up through 109943 (end of 1931 production), and then the D1796 seat up through 130699 (end of 1936 production. For the GP Series tractors, C1785 was used on all GP Standard tractors and on GP Wide Tread from the beginning in 1929 until early into the 1932 production year, changing to the D1796 for 404810-up. D1796 was used on GP-Orchard tractors from Day 1 to the end.

D1796 was the factory-installed seat for the US-A and B tractors as they came into production. Indications are that AD1606 (9-hole) was used on the US-G tractor from day 1. As is always true for manufacturing concerns, inventory remnants of otherwise serviceable seats (C1785 & D1796) were

installed to exhaust supply, so it is within reason to see variance to these statements along the way.

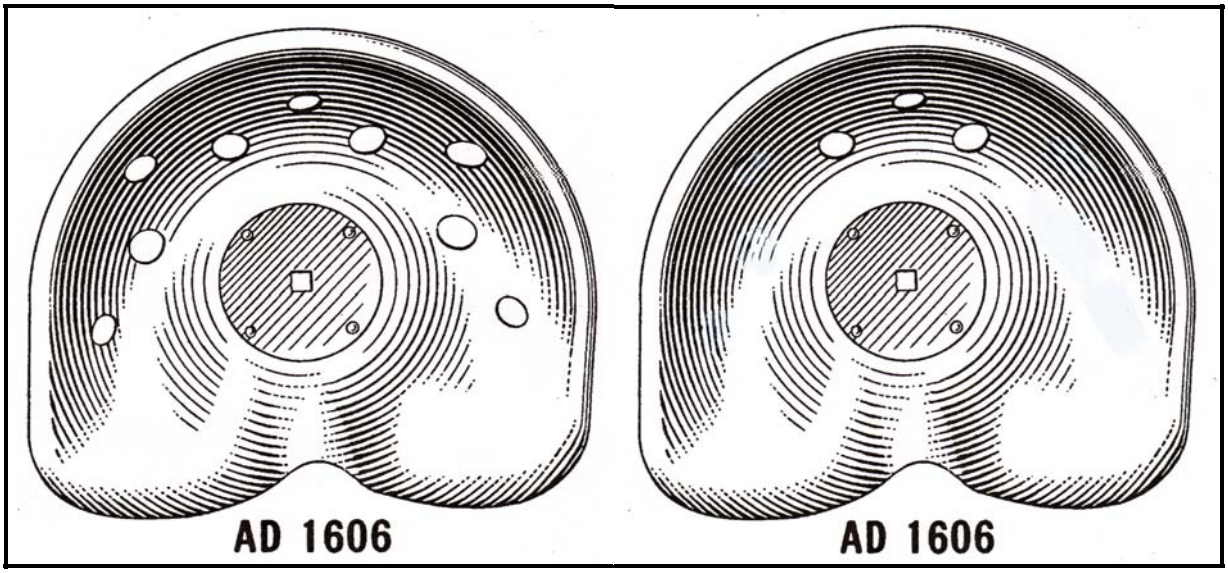

Figure 15-2

AD1606R Seat -- Per JR Hobbs, the AD1606R was first used on 1937 D tractors, and was adopted for use also on late US-A, and B tractors; most likely late in 1937 production. Models D, H, L & LA plus orchard and standard tractors used AD1606R seats for all years. Tractor owners often debate the number of holes to be found in the AD1606R pan seat for a given production year tractor. According to reliable sources which includes the Two-Cylinder Magazine, near-universal use of this seat was for all styled tractors equipped with a pan seat, but the number of holes changed over time! From the beginning, until some time in late 1941 production, the seat had 9 holes. Then it was changed to a 7-hole pattern that held through most of 1944 production. Beginning with 1945 you should expect to see 5 holes. It appears a 3-hole decision was implemented by late 1946, and continued into 1947 when this seat was phased out on A, B and G tractors. Widely used on later tractors, AD1606R remains available from Deere, but it comes with ZERO holes – even-though later parts catalogs show the seat with three! Comparing this trend from the 24-hole seats used during the early US tractor era makes the production use and evolution of pan seats an interesting observation! ++++

Appendix 16

Steel Washer Specifications, John Deere Model H Tractor

(Ref PC304 Parts Catalog)

Old No.	New No.	ID x OD x Thickness	Comments
24H 1R	24H1317	.422 x .750 x .018	
24H 39R	24H1290	.328 x .750 x .035	
24H 43R	24H1306	.406 x 1.00 x .035	
24H 72R	-none-	2.04 x 2.72 x .020	
24H 79R	24H1569	1.781 x 2.25 x .036	
24H 82R	24H1589	2.000 x 3.188 x 0.36	
24H 132R	24H1286	.281 x .500 x .063	
24H 143R	24H1136	.344 x .688 x .065	Zinc
24H 154R	24H1305	.406 x .812 x .065	
24H 155R	24H1299	.375 x 1.25 x .065	
24H 156R	24M7096	.413 x .709 x .063	200HV hardness
24H 169R	24H1325	.469 x .922 x .065	
24H 183R	24H1227	.531 x .812 x .060	
24H 205R	24H1375	.688 x 1.125 x .060	
24H 233R	24H1660	.891 x 1.375 x .060	
24H 234H	24H1660	" " "	
24H 234R	24H1660	" " "	
24H 239R	24H1431	.906 x 2.00 x .060	
24H 448R	24H448	.781 x 1.125 x .090	
24H 469A	24M7180	.512 x 1.457 x .118	200 HV hardness
24H 481R	24H1355	.578 x 1.125 x .120	
24H 482R	24H1211	.562 x 1.375 x .105	
24H 490R	24H1106	.688 x 1.750 x .134	
24H 496R	24H1392	.781 x 1.375 x .120	
24H 502R	24H1236	.812 x 2.00 x .149	
24H 553R	24M7180	.512 x 1.457 x .118	200 HV hardness
24H 560R	24H1236	.812 x 2.00 x .149	
24H 685R	24H1429	.906 x 1.75 x .194	
24H 845R	24H1281	.158 x .375 x .049	
24H 847R	24H1503	1.297 x 2.219 x .060	
24H 954R	24H1589	2.00 x 3.188 x .036	
24H 991R	24H1355	.578 x 1.125 x .120	
24H 992R	24H1211	.562 x 1.375 x .105	
24H 993R	24H1378	.688 x 1.469 x .134	
24H 994R	24H1392	.781 x 1.375 x .120	

Appendix 17, Page 1 of 3
Overhaul - Power Lift Unit

Reference Fig 17-1 -- shows an exploded view of the JD-H Power Lift. The principal parts are:

A - Operating Lever
B - Control Valve
C - By-Pass Valve
D - Valve Housing
E - Relief Valve
F - Pressure Adjusting Washer
G - Drop Speed Adjusting Screw
H - Discharge Cap
I - Remote Cylinder Hose
J - Check Valve
K - Control Arm
L - Cover
M - By-Pass Valve Detent Ball Assembly

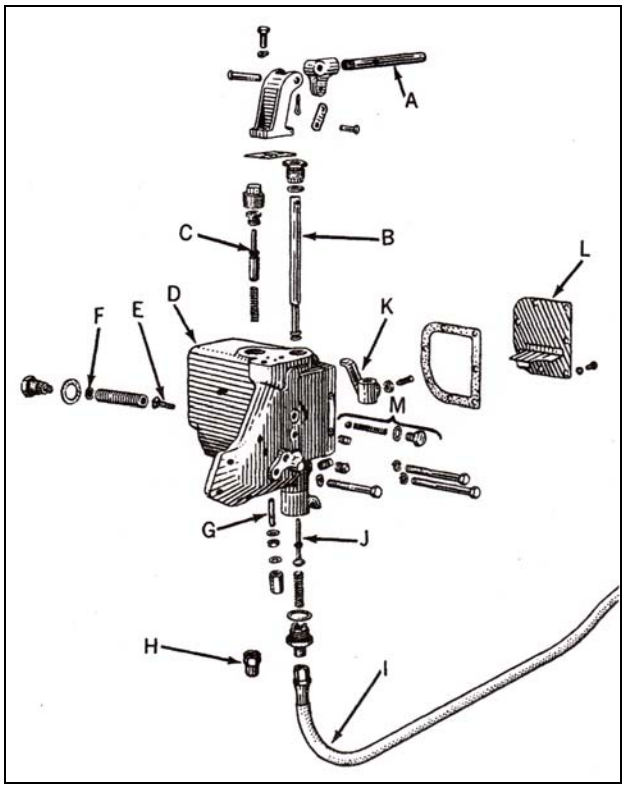

Fig 17-1 -- Housing Exploded

DISASSEMBLY

Control Valve.

Remove cover "A", Fig 17-3 from housing

Loosen yoke lock nut and remove lock screw "B" from control arm.

Loosen packing control arm nut and pull control valve up and out of housing.

Remove packing nut, and packing. Discard packing.

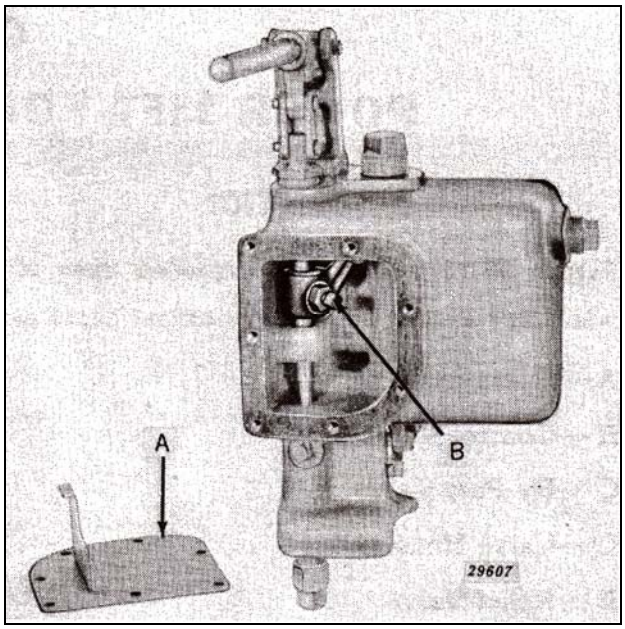

Fig 17-3 -- Control Arm Lock Screw

Relief Valve.

Remove relief valve "A", Fig 17-5. Use care not to lose pressure adjusting washers "B".

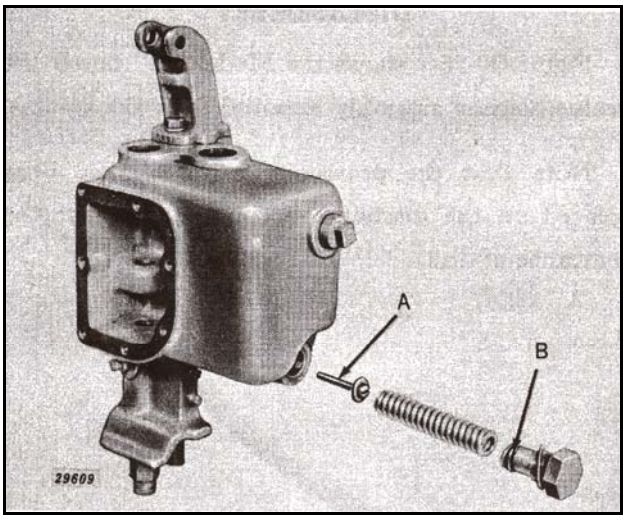

Fig 17-5 -- Relief Valve

By-Pass Valve.

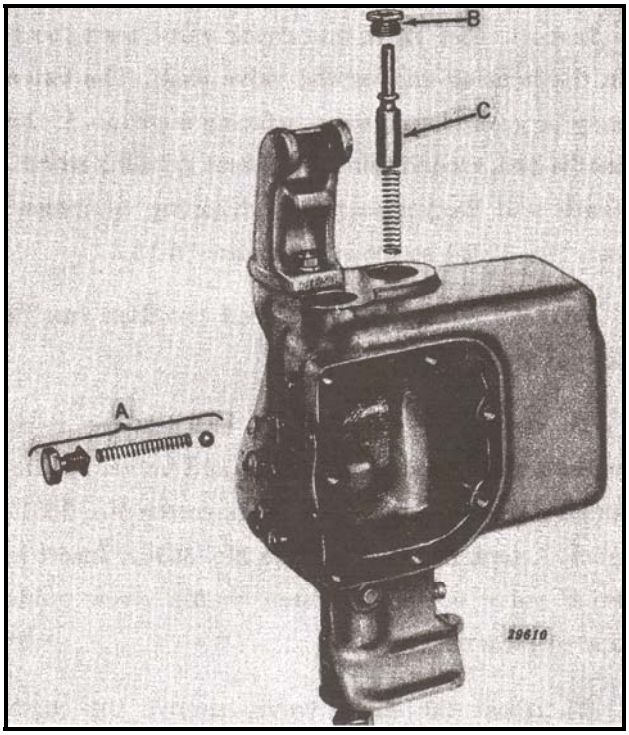

Fig 17-6 -- By-Pass Valve

Remove by-pass valve detent ball and spring assembly "A", Fig 17-6.

Remove retainer plug "B".

Remove by-pass valve "C" and spring.

Check Valve.

Remove check valve assembly "A", Fig 17-7.

Remove fast drop speed control screw assembly "B", Fig 17-7.

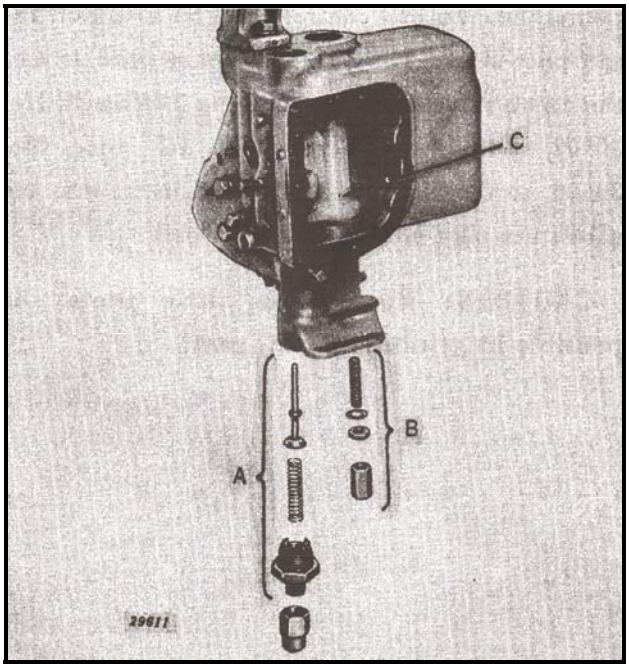

Fig 17-7 -- Check Valve

INSPECTION AND REPAIR

Wash all parts thoroughly with solvent. Blow out all passages.

Inspect valve housing for cracks, holes or other damage. Inspect hole at lower end of

by-pass valve passage "C", Fig 17-7 to be sure it is open. Check freedom of movement of by-pass valve in passage.

Inspect relief valve and check valve seats, both in the housing and on the valve itself. The valve may be ground on a valve re-facing machine. If the seat is bad, recondition it with seat grinding stones. Valves that are in fair condition may be lapped to their seats.

To reseat the relief valve, unscrew the relief valve screw, remove spring and valve. Using a "guided" stone, grind a new seat. This same technique is employed to recondition the check valve seat.

CAUTION - remove as little metal as possible in grinding a new seat.

ASSEMBLY

Make certain that all parts are clean. Use Fig 17-1 as a guide in assembly.

Coat relief valve "E," by-pass valve "C," control valve "B" and check valve "J" with oil before assembling.

Install relief valve "E," spring, adjusting washers "F" and retaining screw and gasket. Tighten screw securely, Fig 17-5.

Install by-pass valve spring, by-pass valve "C," and retainer spring, Fig 17-6.

Install control valve "B" and control arm. Tighten set screw in control arm securely and lock with jam nut. Use new packing on control valve, Fig 17-3.

Install by-pass valve detent ball assembly, Fig 17-6.

Install check valve assembly and fast drop speed control screw, Fig 17-7.

Renewing gasket, install cover "L", Fig 17-1.

Install all remaining plugs and screws.

CHECKING CRACKING PRESSURE

System Operating Pressure is 555 PSI. Relief valve cracking pressure of from 675 to 720 PSI is checked after unit is installed on the tractor. To do this, obtain a 3/8" pipe coupling and a 3/8" to 1/4" pipe reducer. See Fig 17-11.

Remove cylinder from end of hose and install gauge along with its fittings in its place.

Warm lift unit oil to 100°F. With engine at fast idle, move control lever down as far as it will go, and then to "raise".

Cracking pressure will register on the gauge, pressure maintained by closed check valve.

Adjust pressure with 24H1R washers, adding to increase - deleting to decrease.

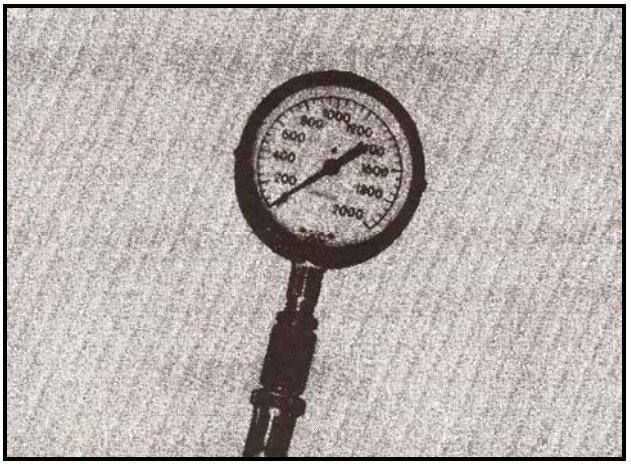

Fig 17-11 -- Gauge for Checking Pressure

Appendix 18, Page 1

Hydraulic Lift System Troubleshooting Chart

Lift Will Not Raise

Cause	Remedy
1. Overload	1. Examine and increase tension of the implement lifting spring or add booster spring to implements.
2. Too light an oil	2. Change to same weight as specified in instruction book for tractor crankcase.
3. Too heavy an oil	3. (same as # 2 above)
4. Not enough oil in lift	4. Fill to oil level hole
5. Relief valve leaking	5. Wash and/or grind valve to a complete seat or replace valve.
6. Yoke loose on control	6. Lock in place with set screw valve shaft
7. Yoke broken	7. Replace yoke
8. Power lift control handle not moved to lowest position before being raised	8. Force handle down against stop on power lift housing and then raise it.
9. Piston cup damage	9. Replace with new cup
10. Ball check valve in piston oil return passageway not sealing	10. See JD-H Service Guide, paragraph 6-4, Servicing Cylinders for "H" power lifts [Clean and Overhaul]
11. Piston connecting rod bent	11. Replace piston & rod
12. Engine at "part throttle"	12. Operate engine at full govern speed

Lift Will Not Start

1. Control shaft not pushed	1. Force valve operating handle down against stop on power lift housing and then raise it.
2. Yoke loose on control valve shaft	2. Tighten set screw
3. Yoke broken	3. Replace with new yoke

Appendix 18, Page 2

Lift Will Not Stay in Raised Position

Cause	Remedy
1. Damaged piston cup	1. Install new cup
2. Leaking check valve	2. Use valve lapping compound and grind valve to a better seat.
3. Oil leakage at the cylinder	3. See JD-H Service Guide, paragraph 6-4, Servicing Cylinders for "H" power lifts [Clean and Overhaul]

Power Lift Oil Overheating in Valve Housing

1. Using oil too light in	1. Change to correct weight of oil viscosity
2. Overloading power lift	2. Check implements as in Complaint # 1 above.
3. Scored pump gears	3. Replace with new parts
4. Failure of the by-pass valve to open fully	4. Remove valve through top filler plug after ball and spring detent are removed through side of valve housing and clean.

Oil Leakage into Crankcase

NOTE: Since the volume of oil in he valve housing changes according to the position of the lift, it is necessary to provide a breathing passageway to permit air to enter the power lift housing. When the lift is raised, air is expelled. The breather passageway is connected to the crankcase and therefore air entering the lift is filtered by the moss-type air cleaner used with the crankcase breathing system.

1. Too light a weight oil. This results in a foaming condition, and the foam is easily forced into the crankcase unnoticed.	1. Replace with proper weight oil
2. Overloading the lift unit	2. Overloading causes oil to operate at high temperature for a long period of time, resulting in overheating
3. Damaged oil seal on power lift pump	3. Replace the oil seal
4. Filling valve housing with oil when the lift is in the raised position - too much oil!	4. Oil level in the valve housing should be determined with the lift in the LOWERED position, so that all the oil in the system is in the valve housing.

Appendix 18, Page 3

Oil Leakage at Cylinder

Cause	Remedy
1. Cylinder installed upside down	1. End of cylinder marked "top" should be installed in the higher position (i.e., facing UP).
2. Arrows on the underside of cylinder	2. Arrows should be on the top side of the cylinder in order to take away any oil that seeps past piston.

Oil Leakage at Cylinder (Continued)

3. Oil leakage past ball check valve in piston	3. See JD-H Service Guide, paragraph 6-4, Servicing Cylinder for "H" Power Lifts. [Clean and Overhaul]
4. Damaged piston cup	4. Replace with new cup leather
5. Oil return plunger binding in bore of piston due to rust or oversized plunger, creating a drag greater than the plunger spring is capable of working against.	5. Replace plunger or remove rust spots with very fine emery cloth.
6. Broken Plunger	6. Replace with new plunger

Oil Leakage Through Ball Check Valve

1. Foreign matter under ball	1. Flush tap or disassembly and clean
2. Check ball, spring, and seat assembly installed backwards.	2. Replace with new assembly
3. Spring lodged under ball	3. Replace with new spring and thread into hole. Do not drive spring into place.

Oil Leakage When Removing Cylinder Hose

1. Engine in operation	1. Stop engine
2. Broken fittings	2. Replace fittings

By-Pass Valve Fails to Open

Lift will raise, but pump continues to labor. Control handle is forced up with full pump pressure - takes considerable force on the handle to move it to the lowered position.	The by-pass valve is not opening for one of two reasons: (1) Engine speed is too low, or (2) Valve passageway contaminated with foreign Material.

~~ NOTES ~~

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From the Author

Born in the Winter of 1936, I grew up on a dairy farm in Southeastern Wisconsin, some 75 miles from down-town Chicago, and 35 miles from Milwaukee. Chicago may as well have been several hundred miles away. I doubt my Pops ever made it there. Trips to the grocery store, the blacksmith shop, the feed store to have grain ground, and the John Deere dealership for parts were near about the only trips made in those days. There were also holiday trips to my Grandparents, either my Mom's folks, or Dad's. And if my Grandparents hadn't had indoor plumbing, there's no telling how late in life I would have learned there was something besides the outdoor privy with a catalog from either Sears Roebuck or Montgomery Wards. We did not have a phone, and were fortunate, I reckon, to have electricity! Our main daily contacts with others was the mailman, and the milkman who always, or so it seemed, came too early.

I gleaned most of my joy, so it seemed, from field work involving my Dad's 1936 Model A John Deere. I just loved to drive it; especially after Dad hired Ed Engle, our blacksmith (Spring Prairie, Wisconsin) to cut off the steel wheels with lugs and mount rims for 10-38 rubber tires on the rear and something like 6:16's up front. This came about as the country roads began to be paved. The township leaders didn't want farmers cutting up the new "oil-and-pea-gravel" mix they called pavement; all of which began in earnest as WW II ended. I was nearing 10 years old at the time, and finally was able to start the old "A" as well as drive it; what a thrill. The most favored times on the farm were harvest times, this even before I was able to operate the tractor much. And many of those harvest-time memories are recorded in the archives of Yesterday's Tractor Magazine. Go to the website <www.ytmag.com>, then to "articles," and under articles see "history." Look for "Grain Threshing in the Early 40's," and also the "harvesting corn & hay" articles to follow. Those four articles put my love for those old John Deere Model "A" tractors, and for my Dad into perspective. Dad acquired the 36 A when it was 4 years old. We bought another A, a 37 model, during the late 40's and used it mainly for picking corn. It had the hottest magneto in town, and would always start real easy – something to treasure with a two-row mounted corn picker!

I left farm life in January 1955, enlisting in the US Air Force. After serving a dozen years as an electronics technician, I was commissioned and went into Communication Systems Engineering, retiring from the Air Force in 1976. I served as an educator during most of my Air Force years. Much of my efforts were in preparation of texts, workbooks and examination items used in the technical training programs. Following my Military Service Career, I worked for Martin Marietta (now Lockheed Martin) as an Electrical Engineer. My main tasks were in engineering planning and management in the test equipment production to support the Apache Helicopter's Night Vision/Hellfire weapon system. After early retirement from Martin in late 1992, we relocated to the Florida Panhandle where we enjoyed acreage and space to work with tractors. We "gentleman" farmed raising corn, peas, and beans plus sunflowers using two old JD tractors, a 41 A and a 42 H, and a 47 IHC Farmall H. We also had lots of fun with the A on hayrides with church groups and with the JD-H in various ways to include cutting acres and acres of lawn between our home and the church grounds. Life in Florida was kind to us both in material ways and in our Spiritual Growth. While in the Florida Panhandle, I spruced up a half dozen tractors (three JD tractors and three Fords). And before '92 while in Orlando, I "spruced up" several JD tractors (2-B's, an MT, and a 50) and two IHC tractors, one a F-20, the other a Super M Farmall. I like the “red ones” too!

In 2002, we left the farming equipment and Florida behind to move closer to family in South Texas. Once the home we purchased was refurbished to our satisfaction, I sought something to do. And it was during this period of time that Little Johnny came into our lives – Little Johnny was the inspiration to begin tech writing once again – with the first JD-H Restoration Guide published in 2005! Since that point in time, I’ve prepared a Service Guide, and a Carburetor Overhaul Guide; and have numerous “specialty” books and eBooks dealing with all aspects of the “H” Series tractors. Those were the days!

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